Food and Agriculture Organization of the United Nations

WILDCHECK

ASSESSING THE RISKS AND OPPORTUNITIES OF TRADE IN WILD PLANT INGREDIENTS

TRAFFIC

Medicinal Plant Specialist Group

Part of IUCN SSC Species Survival Commission

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ABOUT FAO

The Food and Agriculture Organization (FAO) is a specialized agency of the United Nations, supporting the transformation to more efficient, inclusive, resilient and sustainable agri-food systems. The conservation and sustainable use of wild plants and non-wood forest products is a key area of work in the FAO Forestry Division, with the aim of contributing to the sustainable management of the world's forests, the conservation of biological diversity, and ultimately improving livelihoods, food security and nutrition.

ABOUT TRAFFIC

TRAFFIC is a leading non-governmental organization working globally on trade in wild animals and plants in the context of both biodiversity conservation and sustainable development.

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ABOUT IUCN SSC MPSG

The IUCN SSC Medicinal Plant Specialist Group (MPSG) is a global network of specialists contributing within their own institutions and in their own regions, as well as world-wide, to the conservation and sustainable use of medicinal plants. The MPSG was established by the Species Survival Commission of the International Union for Conservation of Nature (IUCN) in 1994 to increase global awareness of conservation threats to medicinal plants, and to promote sustainable use and conservation action.

Argan oil © Pixabay

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ABBREVIATIONS AND ACRONYMS

AARENAMAPA	Agroindustrial Association of Natural Resources of the Manuripi River in Pando
ABNC	Associación Brasilña de Nueces
ABS	access and benefit sharing
AMPAN	Ayurvedic Medicine Producers Association of Nepal
ANS	additives and nutrient sources
ANSAB	Asia Network for Sustainable Agriculture and Bioresources
ASPROGOAL	Association of Rubber and Almond Producers
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species
CONABIO	Comisión Nacional para el Conocimiento y Uso de la Biodiversidad
COOPAVAM	Cooperative dos Agricultores do Vale do Amanhacer
COP	Conference of the Parties
CPI	Consumer Price Index
DOP	designation of origin
EFSA	European Food Safety Authority
ESG	environmental, social and governance
ETI	Ethical Trading Initiative
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FPIC	Free, Prior and Informed Consent
FSC	Forestry Stewardship Council
GDP	Gross Domestic Product
GIZ	German Agency for International Cooperation
HEAN	Herbal Entrepreneurs Association of Nepal
HS	Harmonized System
ICCO	International Cocoa Organization
ICMBio	Institute for the Conservation of Biodiversity
IPLC	Indigenous Peoples and Local Communities
IPR	intellectual property rights
ITC	International Trade Centre

ITUC	International Trade Union Confederation
IUCN	International Union for Conservation of Nature
JABAN	Jadibuti Association of Nepal
NEHHPA	Nepal Herbs and Herbal Products Association
NEOAD	New Partnership for Africa's Development
NGARA	Network for Natural Gums and Resins in Africa
NOP	National Organic Program
NWFP	non-wood forest products
PDO	protected designation of origin
PEFC	Program fir the Endorsement of Forest Certification
PGI	protected geographical indication
RBG	Royal Botanical Gardens
SANBio	Southern Africa Network for Biosciences
SAR	Special Administrative Region
SECO	Swiss Secretariat for Economic Affairs
SIN	Sustainable Nut Initiative
TCG	trusted computing group
TCM	Traditional Chinese Medicine
UCFA	Union of Women's Cooperatives of the Arganeraia
UEBT	Union for Ethical Biotrade
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
USD	United States Dollar
USDA	United States Department of Agriculture
USDoL	United States Department of Labor
USFWS	United States Fish and Wildlife Service
WCMC	World Conservation Monitoring Centre
WHO	Wirkd Health Organization
XAF	Central African Franc

EXECUTIVE SUMMARY

School students under a baobab, Ghana © Axel Fassio/CIFOR

Thousands of consumer products around the world contain ingredients obtained from wild plants. Wild harvest accounts for some or all of the harvest of the majority of plant species in trade (between 60-90 percent). Wild-harvested plants often come from the most biodiverse ecosystems on Earth and many have been used traditionally or by local communities for generations. While these products have global markets and provide critical sources of income, they can also have deep ties to particular cultures and places.

Demand for wild plant ingredients is growing rapidly, having grown by more than 75 percent in value in the past two decades. As a result, thousands of harvested species are at risk from a combination of overharvesting and habitat loss: of the 21percent of medicinal and aromatic plant species whose threat status has been assessed, 9 percent are considered threatened with extinction.

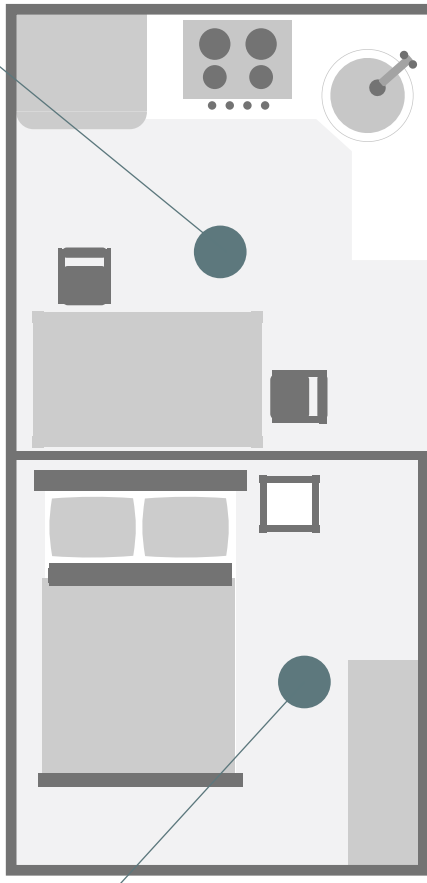
Despite their ubiquity, importance, and the threats facing them, wild plant ingredients are often obscured from consumers and escape companies' due diligence due to a lack of awareness and traceability. Best practice standards exist, but have yet to capture a significant portion of the market.

This report aims to address these challenges by making information on a selection of 'flagship' wild plant ingredients, dubbed the Wild Dozen, readily available and easy to understand. These Wild Dozen represent the range of uses, threats, and opportunities that can face all types of wild-harvested plant ingredients. By offering this information without the obligation of a specific follow-up action (for example through certification or policy change), it is hoped that a wide range of users will access this information as a step towards responsible sourcing. Along with a broader update on the state of wild plant trade, the report provides a 'profile' on each of the Wild Dozen ingredients, summarizing critical facts on production and trade. Each profile contains a traffic-light risk rating on biological and social factors, along with an overview of opportunities for responsible sourcing. The information is aimed at industry, consumers, policy-makers, investors, and practitioners, concluding with a summary of what these various stakeholders can do to contribute to a sectoral shift towards responsible sourcing of wild plant ingredients.

Of the twelve flagship wild-harvested ingredients reviewed, the majority of the risk assessment results (both biological and social) are Medium or High, with only one Low biological and one Low social result. This shows that these ingredients must be considered in due diligence, policies, and purchasing decisions. However, across the twelve ingredients, a range of engaging opportunities are noted including sustainable harvest, wildlife conservation and restoration, access and benefit sharing, research, partnerships, and engagement with best-practice standards and certification.
The outlook for these flagships, and for wild ingredients as a whole, can be bright if appropriate actions such as those suggested throughout the report are taken by various stakeholders now.

THE WILD INGREDIENTS HIDDEN IN OUR EVERYDAY PRODUCTS

KITCHEN



Brazil nuts are harvested entirely from wild, tall trees in the Amazon region, where they play an important role in the Amazonian ecosystem, yet they are increasingly threatened by deforestation.

Shea butter is one of the most ancient edible vegetable oils and has been consumed for millennia. It is traditionally collected by women across the "Shea belt" in Africa, contributing to the incomes of an estimated three million women. Rich in healthy fats, it is often used as a cocoa butter equivalent, in baked goods or ice cream.

Gum arabic is a vital, yet usually undeclared, ingredient in soda – it comes from the sap of two Acacia tree species found across the Sahel region of Africa. These trees can play a major role in halting desertification and supplementing income of harvesters (typically small-scale farmers or low-income ranchers), yet they too are increasingly threatened by climate change.

Herbal tea often contains **liquorice**, which is extracted from the roots of the perennial liquorice herb, often by rural communities in Uzbekistan and Azerbaijan. A range of other wild-harvested ingredients can be found in herbal tea such as nettles, hawthorn, elder, bibhitaki fruit, and juniper.

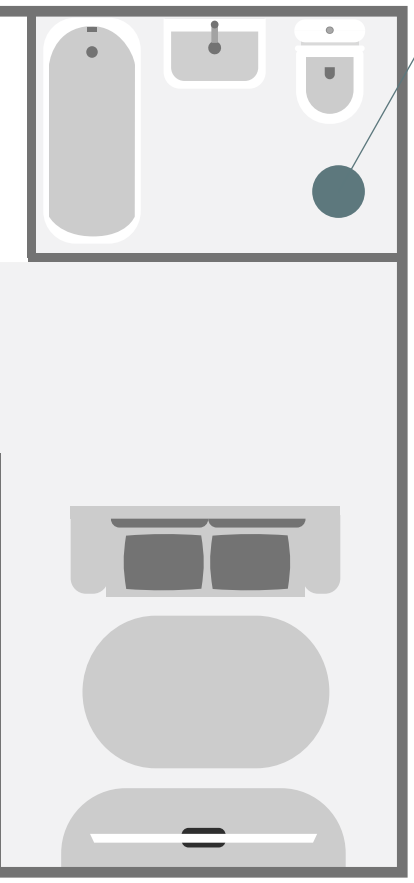
Juniper is a key ingredient in gin manufacturing and is often wild-harvested by marginalized communities in eastern Europe.

Your frozen treats can include wild ingredients like **gum arabic** and **Brazil nuts**.

BEDROOM

Frankincense is a popular ingredient in perfume. It comes from the sap or resin of a variety of *Boswellia* tree species located in north-eastern Africa. Data on the quantities and impacts of harvesting are severely lacking. The resin is typically collected by impoverished local families for whom frankincense is an critical source of income.

Incense often contains wild ingredients such as **frankincense** and **jatamansi**. These ingredients can also be found in aromatherapy/essential oils and in cosmetics.



BATHROOM

Your lotion likely contains **shea butter**, which is produced from the nut of the shea tree, typically harvested in west Africa by women. It could also be scented with others from the Wild Dozen list such as **frankincense**, **liquorice**, or **juniper**.

A range of skin and hair care products contain **argan oil**, produced from the seed of the argan tree, often harvested by Indigenous female cooperatives. The argan tree forms the basis of a Globally Important Agricultural Heritage System in Morocco.

Skincare products contain a wide range of wild-harvested plant ingredients, such as **baobab oil** – cold-pressed from the seed of the iconic baobab tree found across sub-Saharan Africa. It is harvested by families as part of a diversified income from non-timber forest products. Skincare products ca n also contain other Wild Dozen list ingredients such **shea butter**, **argan oil**, and **frankincense.**

Candelilla wax is an important ingredient in cosmetics, as well as shoe polishes and chewing gum. It can go by the ingredient name E902. Sometimes marketed as a vegan alternative to beeswax, it is extracted from a shrub in the Chihuahuan desert of Mexico using a multi-step process carried out by locals involving sulphuric acid.

Dietary supplements, phytomedicines, and traditional medicines often contain wild plant ingredients:

- Pygeum, sourced from the bark of the Vulnerable **African cherry tree**, is used to treat prostate conditions in men.
- **Jatamansi** is a critically endangered herbaceous plant harvested by high-altitude communities in the Himalayas, the roots of which are used in traditional medicine including Ayurveda, Unani and Chinese systems. It is used to treat a variety of mental health conditions like epilepsy and hysteria, as well as for its anti-bacterial and anti-fungal properties.
- **Goldenseal** is a vulnerable forest plant from the United States of America and Canada. It is used to treat infected mucosal membranes, including the mouth, respiratory and gastrointestinal tract.

*For references, see Wild Dozen Profiles.

WILD-HARVESTED PLANTS TRADE AT A GLANCE

SUPPLY

1.2 BILLION

people in the tropics **highly dependent on nature** to meet their **basic human needs**[1]

Of nearly

60 000 TREE SPECIES worldwide:[2]

10% have a **medicinal or aromatic use**

1/5 are **directly used by humans** for food, fuel, timber, medicines, horticulture, and more

30% are **threatened with extinction**

142 are **recorded as extinct** in the wild

The

MAIN THREATS to tree species are:[2]

habitat loss

over-exploitation

invasive pests and disease

climate change

only **21%** species have had their **conservation status assessed**[3]

9% are **threatened with extinction**

1 Fedele *et al.*, 2021
2 Botanic Gardens Conservation International, 2021
3 D. Leaman, IUCN Medicinal Plant Specialist Group, *in litt.* to A. Timoshyna, 14 June 2021

DEMAND

DEMAND IS GROWING

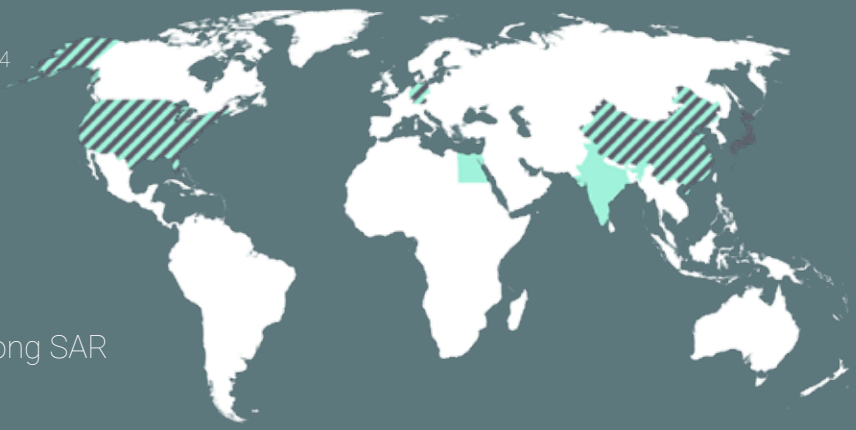
for medicinal and aromatic plant species, between 2000 and 2020:

+75% **trade value growth** once adjusted for inflation[4]

+22% **growth in volume of medicinal and aromatic plant species** in global trade[4]

TOP TRADERS

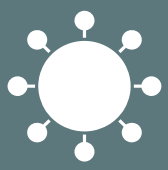
of wild-harvested plant ingredients by value in 2020[4]



EXPORT	IMPORT
China	USA
India	Germany
Germany	Japan
USA	China
Egypt	China, Hong Kong SAR

Many wild plant ingredients are used in

COVID-19 PREVENTION



and remedies, resulting in a recent increase in demand[5]

3.5-5.8 BILLION

global users of non-timber forest products[6]

There is evidence of

ILLICIT TRADE

in these species:

23%

of all EU wildlife seizures in 2019 were of plant-derived medicinals[7]

4 Based on the latest available UN COMTRADE data (2021)
5 For example see Smith *et al.*, 2021
6 Shackleton and de Vos, 2022
7 TRAFFIC, 2021

Workers sort, repack and ship Gum Arabic © Salahaldeen Nadir/World Bank

INTRODUCTION

STATE OF WILD PLANT TRADE

Argan seeds ©Pixabay

Wild plants play a vital role in the livelihoods and cultures of communities around the world, in wealthy and poor countries alike. Food, medicine, spices, household implements, cosmetics, and other products gathered from the wild contribute to subsistence and both local and global trade.

However, unbeknownst to many global consumers, numerous products in common use — herbal remedies, food, drink, cosmetics, supplements, and even furniture — come from wild-harvested plants (Jenkins *et al.*, 2018).

Less well-known is that many wild ingredients come from the most biodiverse ecosystems on Earth, and the majority of these have been used traditionally or by local communities for generations (*Ibid.*).

While these products have global markets, they also usually have deep ties to particular cultures and places. Wild-harvested shea butter and baobab powder from Africa, Brazil nuts and Açai berries from South America, and liquorice root and wild thyme from Europe and Central Asia are just a few examples of what can be found on shop shelves and in our homes.

Although cultivation is increasing, wild harvesting still accounts for some or all of the raw material produced for the majority of plant species in trade. Some 60-90 percent of medicinal plant species, for example, are thought to be wild-collected (Mulliken and Inskipp, 2006, cited in Jenkins *et al.*, 2018).

Demand for plant ingredients is growing. Once adjusted for inflation, the global trade value of MAPs has grown by more than 75 percent in the last two decades (from inflation-adjusted USD 1.7 billion in 2000 to USD 3 billion in 2020), based on the latest available UN COMTRADE data.[1] Volume of MAPs in global trade has grown by 22 percent, from 425 636 metric tonnes in 2000 to 519 297 metric tonnes in 2020. The world's top exporters by value in

BOX 1

DEFINITIONS

Throughout this report, wild-harvested plant ingredients are referred to in a number of ways.

The term ***medicinal and aromatic plants (MAPs)*** is used to refer to a group of wild-harvested plant ingredients used in medicines and aromatherapy, but that are also often used in other industries for example food, beverage, beauty (Timoshyna and Drinkwater, 2021).

The term ***non-wood forest products (NWFPs)*** is used to describe goods derived from forests and other wooded land that are tangible and physical objects of biological origin other than wood (Muir *et al.*, 2020).

The term ***wild products or species*** refers to biological resources that are not cultivated (including plants and fungi) sourced from many types of ecosystems and habitats in addition to forests through the activity of gathering (Muir *et al.*, 2020).

Jatamansi plant
©Khilendra Gurung

2020 were China, India, Germany, the United States of America and Egypt, while the United States of America, Germany, Japan, China, Hong Kong SAR were the top importers. These figures do not necessarily reflect the origin of raw material or the domestic value, but rather movement through the value chain. For example, Germany typically imports raw material and exports processed or manufactured products. Further, it is widely accepted that these data are incomplete and that official figures are likely to be underestimates (Sorrenti, 2017; Muir *et al.*, 2020; Martinez *et al.*, 2021).

There are signs that trade growth has accelerated with the interest in herbal remedies as prevention and treatment options against COVID-19 (Timoshyna *et al.*, 2020a). Although wild ingredients typically are not visible in pharmaceutical products, COVID-19 has brought to light the continued and renewed use of, and reliance on, wild species as ingredients in traditional and modern medicines (Brendler *et al.*, 2020; Hossain *et al.*, 2020; Grigore *et al.*, 2020; Timoshyna *et al.*, 2020b). This includes wild plant ingredients in traditional medicines, herbal and wellness products, and in COVID-19 vaccines, for example adjuvant formulations originating from the bark of the wild-harvested *Quillaja saponaria* tree (Borrel, 2020; Buchanan, 2021; Paudyal *et al.*, 2021; Sharma *et al.*, 2020).

Though data are limited, early indicators suggest that the COVID-19 pandemic has amplified the volatility of already unpredictable herbal markets (Eboreime *et al.*, 2020). For example, in the US, consumers spent an estimated USD 11.3 billion on herbal dietary supplements in 2020, which was a 17.3 percent increase from 2019 and the first time that sales have surpassed USD 10 billion (Smith *et al.*, 2021). Governmental responses in several regions have included mention of, or official endorsement for, herbal medicines, which may put further pressure on already imperilled wild-collected species (Cyranoski, 2020; Kapepula *et al.*, 2021; Pulla, 2020; Smith and Rueda, 2021; Timoshyna *et al.*, 2020b). A striking example of this process occurred recently in Uganda where surges in infections have led to governmental approval of herbal treatments that contain the globally threatened species *Warburgia ugandensis* (Wasswa, 2021). Such use of plant ingredients can pose both a threat (clearly recognized in some cases, and hidden in others) and an opportunity for conservation of species, with potentially positive reinforcement of the role of nature in everyday products and life-saving medicines, should the appropriate environmental and social safeguards be put in place.

Unbeknownst to many consumers, **MANY COMMON INGREDIENTS COME FROM WILD-HARVESTED PLANTS**

[1]*Based on the latest available UN COMTRADE data for the Harmonized System (HS) Code 1211 - Plants and parts of plants, incl. seeds and fruits, of a kind used primarily in perfumery, medicaments or for insecticidal, fungicidal or similar purposes, fresh or dried, whether or not cut, crushed or powdered.*

60 000 plant species are estimated to be used globally for medicinal and related purposes (for example cosmetics, aromatherapy, food and drink), of which about **26 000 have a well-documented use**. Roughly 10 percent of these (3 000) are traded internationally. The global threat to plants used for medicinal and aromatic purposes has been assessed **for only about 21 percent of the total 26 000 species**, with **approximately 9 percent considered threatened** with extinction in the wild based on the Red List criteria of the International Union for Conservation of Nature (IUCN) (D. Leaman, IUCN Medicinal Plant Specialist Group, *in litt*. to A. Timoshyna, 14 June 2021).

Due to the piecemeal nature of assessments conducted to date, it remains unclear how representative these figures are for medicinal plants as a whole. Comprehensive assessments of all known medicinal plants have been conducted for Europe and are underway for North America. However, **more research is needed to determine the conservation status of medicinal and aromatic plants**, especially in less-developed countries (C. Meredith, New Mexico BioPark Society, *in litt*. to C. Schindler, 14 September 2021). Recent efforts to compile extinction risk information on the tree species of the world showed that of the nearly 60 000 tree species worldwide, 30 percent are threatened with extinction, and at least 142 are recorded as extinct in the wild (Botanic Gardens Conservation International, 2021). The main threats to tree species are habitat loss, overexploitation, and the spread of invasive pests and diseases, with climate change having a clearly measurable impact (*Ibid*.). An estimated 10 percent of all trees (nearly 6 000 tree species) have a medicinal or aromatic use ranging from mainstream modern medicine, traditional systems or for local healthcare needs of indigenous people (*Ibid*.).

At the international level, the Convention on International Trade in Endangered Species (CITES) provides an important (and often the only) form of trade regulation with more than 800 species of medicinal and aromatic plants listed in Appendix II. In 2006–2015, 43 CITES Appendix II wild species were traded legally—some 25 000 t in total. The top three exporters were Mexico, Cameroon and South Africa, together representing 75 percent of all wild-sourced exports (kg as unit), while five countries were responsible for 77 percent of imports: France (26 percent), the United States of America (16 percent), Japan (15 percent), Germany (11 percent) and Spain (7 percent) (CITES Trade Database, 2018, cited in Timoshyna *et al.*, 2020b).

There is evidence of **illicit trade in these species**. In 2019, **23 percent of all wildlife seizures reported by the EU Member States were of plant-derived medicinals** —by far the largest category of all reported seizures. This included **130 706 plant-derived medicinal items** (and an additional ca. 1 786 kg and ca. 463 litres), with many Appendix II-listed MAPS seized, including Ginseng *Panax quinquefolius*, Candelabra Aloe *Aloe arborescens*, African Cherry *Prunus africana*, and various orchid and cacti species (TRAFFIC, 2021).

Wild plants are harvested for commercial purposes all over the world under a wide range of different social, cultural and economic conditions. People engaged in the harvest are often **poor, rural and marginalized, with a high proportion of women, also frequently involving children and the elderly**. In some cases, there are few other opportunities to earn income, and in others, plant harvesting supplements subsistence agriculture and other livelihood strategies. Many harvesters come from ethnic minorities or Indigenous Peoples and Local Community (IPLC) groups.

Traditional knowledge is widely used to develop commercial products, including for the Wild Dozen ingredients highlighted in this report. Some knowledge is common and widely shared, including across international borders, and other knowledge is restricted to specialists. Knowledge extends beyond the uses of species to include harvesting (for example, knowledge of plant parts, seasons, sustainable quantities, and harvesting cycles), cultivation, management, processing, and other aspects of relevance to commercial value chains (FAO and UNEP, 2020).

An estimate of the **global income from the production of non-wood forest products (NWFPs)** was USD 88 billion in 2011 (inflation-adjusted to 2020 value, USD 101 billion), coming for the most part (USD 77 billion, or inflation-adjusted, USD 89 billion) from the production of plant-based NWFPs (FAO, 2014). On average, 90 percent of European house-

holds and an estimated 1 billion people around the world consume NWFPs (Lovric *et al.*, 2021; Burlingame, 2000).

26 percent of European households collect NWFPs, with an annual estimated economic value of USD 26 billion (EUR 23.3 billion) (Lovric *et al.*, 2020).

Most wild plants in commercial trade are harvested and traded with little consideration for sustainability or whether local harvesters are fairly paid for the products they produce. They are traded as bulk commodities, with links to harvesters and harvesting conditions diminishing as the value chain moves towards consumers. This may be due to a lack of awareness, visibility, motivation, or accountability: ingredients can be difficult to trace back to their source along complex supply chains, information on harvesting practices and conditions is scarce, and conservation and social risks and opportunities are poorly documented, understood, or shared. Businesses also feel little pressure from buyers or customers to report on the sustainability of wild-sourced ingredients.

Although voluntary certification and best-practice standards are available, they have yet to capture a significant portion of the market (see Box 2 on 'Voluntary certification of wild-harvested ingredients'). Public understanding of wild ingredients, their sustainability, links to biodiversity, and the strong cultural and historical ties to IPLCs of most wild products is also, therefore, low.

BOX 2

VOLUNTARY CERTIFICATION OF WILD-HARVESTED INGREDIENTS

A range of voluntary certification standards can be applied to wild plant ingredients, including the Forest Stewardship Council (FSC), Rainforest Alliance, Fair for Life, the Union for Ethical Biotrade (UEBT) and some organic standards (for example EU Organic, USDA NOP). These provide different elements of risk mitigation and encourage good practice with resource management.

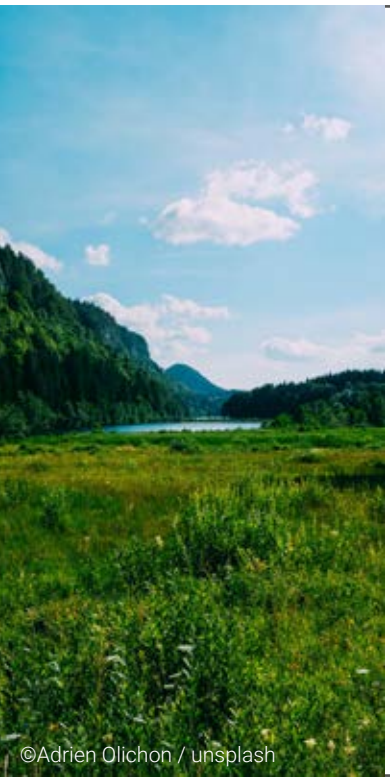
One scheme called FairWild was specifically developed to address risks of wild harvest management systems and to integrate appropriate social and biological safeguards. **The standard is recognized as best practice for wild plant sourcing by the Convention on Biological Diversity.**

FairWild-certified products are now sourced from 13 countries (Somalia, Bulgaria, Spain, Georgia, Kazakhstan, Hungary, Poland, Serbia, El Salvador, India, Zimbabwe, Nepal and Bosnia and Herzegovina) and sold in over 60 countries.

Although growing year-on-year, trade in certified ingredients represents a small fraction of the world's trade in wild-harvested plant material. Many businesses using wild-sourced ingredients are not yet ready to make the commitment to third-party verified systems.

©Shutterstock

The underlying challenges remain to inspire and support corporate and consumer action on behalf of wild plants in trade and those who harvest them, and to encourage policy-makers to consider these issues in planning and decision-making related to wild plants, their associated ecosystems, and socio-cultural systems. This report directly contributes to addressing these underlying challenges, aiming to bring to light wild plant ingredients, increase understanding of the value of wild plants, and support the uptake of good sourcing practices in wild plant trade chains.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BOX 3

PREVENTING "PLANT BLINDNESS"

Plants make up around 80 percent of all biomass on Earth, play a fundamental role in ecosystems, and support humans and other animals by providing food, medicine, oxygen and shelter (Jose *et al.*, 2019). Modern estimates of terrestrial plants are in the order of 400 000 known species (Nic Lughada *et al.*, 2016). However, the tendency to not value plants in the environment – also known as "plant blindness" – has left plant conservation initiatives lagging behind animal conservation projects (Balding and Williams, 2016). This is a challenge primarily in wealthy countries; in most high-biodiversity countries, rural communities continue to rely on cultivated and wild plants for subsistence and livelihoods.

The term "plant blindness" was introduced in 1999 by Wandersee and Schussler, describing the phenomenon as the "inability to see or notice the plants in one's own environment, leading to the inability to recognize the importance of plants in the biosphere and in human affairs".

It also refers to the "the misguided, anthropocentric ranking of plants as inferior to animals, leading to the erroneous conclusion that they are unworthy of human consideration." Conservation programmes can contribute to reducing this bias and encourage plant conservation by raising awareness on the importance of plants in the wider community and to life on Earth.

For **companies** manufacturing and selling final products, which ultimately drive the trade in wild plant ingredients, there is a lack of awareness of the extent to which their products depend on wild ingredients, and a lack of interest to demonstrate the sustainability of wild plant supply chains. However, current risks related to the global decline in biodiversity and ecosystem services are a direct threat to the supply of wild plant ingredients. A 2021 World Bank Report estimates that the collapse of select ecosystem services could result in the decline of global GDP in the order of USD 2.7 trillion annually by 2030 (Johnson *et al.*, 2021). This report aims to engage business agents, such as trade associations, processors, and brands, to understand critical risks and opportunities in a selection of high-profile supply chains and catalyse market transformation by motivating sustainable sourcing practices.

For **consumers,** the main challenge is that many wild plant ingredients are hidden while the need to ensure sustainable and equitable sourcing practices is not recognized. This report aims to address this by fostering an understanding of wild plants in everyday products, and encouraging partnerships to roll-out awareness and behavioural change campaigns to inspire and persuade consumer change.

Finally, the report aims to encourage more "biodiversity-smart" policies and interventions related to conservation and sustainable use of wild plants, in recognition of their value for healthy ecosystems, lives, and livelihoods. While it is encouraging that parties to the Convention on Biological Diversity (CBD) have recognized the importance of plants as the basis of all life on Earth and the building blocks of terrestrial ecosystems, the post-2020 Global Biodiversity Framework must catalyse urgent change. This report aims to trigger firmer commitments and actions on behalf of countries to respect old and new biodiversity targets (for example the Global Strategy for Plant Conservation), while creating an enabling environment for businesses using wild plant ingredients to thrive, and for improved lives and livelihoods of wild plant harvesters.

ABOUT WILDCHECK

WildCheck will help open the cupboard door on hidden ingredients, illuminate risks and opportunities, and create a recipe for sustainability action.

The goal of the WildCheck suite of tools (including this report, the WildCheck platform, and the #WeUseWild Pledge) is to offer objective insights and advice on sourcing of wild plant ingredients to support business, investment, and policy scoping. By offering accessible and easily understandable information without obligation to a specific prescription for follow up action (for example through certification or policy change), it is hoped that a wide range of users will access the WildCheck suite of resources as a critical first step in the planning and implementation of responsible sourcing action, shaping of legislative frameworks, and designing programmes or projects based on wild plant harvesting.

The approach detailed in the Methods can be used to investigate any wild plant (or fungi) ingredients. Although this report focuses on twelve flagship species, more species face similar threats, opportunities, or uses; some of which are noted in each profile. As there are an estimated 60 000 plant species used globally for medicinal purposes, the Wild Dozen are intended to be a starting point for understanding the wild harvest.

WHO IS THIS REPORT FOR?

- **Businesses** such as brands, associations, traders, and processors, who may or may not be aware that they are using wild plant ingredients.
- **Consumers** interested in making responsible and ethical purchasing decisions.
- **Decision-makers** such as legislators and policy-makers.
- **Investors** seeking to assess the opportunities surrounding the commercial value of wild plants and associated risks.
- **Practitioners** such as agriculture, forestry, and development professionals working in local, national, or international organizations and entities, seeking to develop projects and programmes on wild plants or to influence policies.
- **Producers** of wild-harvested plant ingredients, including harvesters and producing companies.
- Media, students and others interested in building their knowledge of sustainable wild harvests.

Nuts and fruits market in Delhi, IN ©Anastasiya Timoshyna/TRAFFIC

Shea nut butter processing ©TREEAID

METHODS

SELECTING THE 'WILD DOZEN'

The ingredient profiles listed in this section focus on the "Wild Dozen"— twelve wild plant-derived ingredients important in trade that act as flagships of the opportunities and challenges of wild-sourcing, with the longer-term aim of changing industry practices and consumer perceptions.

The list was selected to include species across the spectrum, from those that are:

- Already subject to careful management to avoid over-harvesting and ensure equitable trade;
- In need of more attention now due to their susceptibility to harvesting pressure (for example over-collected, vulnerable to unsustainable trade), and/or being in supply chains problematic due to social inequality of trading practices;
- Likely to require more attention in future as markets for them grow.

This is a selection of important species in trade that are mostly wild-harvested and, in totality, provide a representation of trade in wild plant NWFPs. The intention, as with other 'flagships' in conservation, is to use these species as illustrative examples and to drive forward positive actions for conservation and livelihoods across the board.

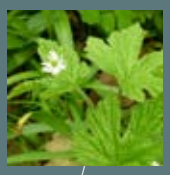
THE 'WILD DOZEN' INGREDIENTS ARE:

CANDELILLA WAX, E902

Euphorbia antisyphilitica

GOLDENSEAL

Hydrastis canadensis



BRAZIL NUT

Bertholletia excelsa

JUNIPER

Juniperus communis

LIQUORICE

Glycyrrhiza glabra

JATAMANSI, Spikenard

Nardostachys jatamansi

AFRICAN CHERRY, *Prunus*, Pygeum

Prunus africana

SHEA BUTTER

Vitellaria paradoxa

GUM ARABIC, Acacia Gum, E414

Senegalia senegal

ARGAN OIL, Moroccan Oil

Sideroxylon spinosum

BAOBAB

Adansonia digitata

FRANKINCENSE, Olibanum

Boswellia sacra

Many of the risks, opportunities, and resources profiled in this report are also common to other wild-harvested ingredients or species beyond the Wild Dozen. Some of these species are referenced throughout the profiles (see 'Other relevant species' sections).

Baobab fruit ©Pixabay

NAVIGATING THE WILD DOZEN PROFILES

The report contains a series of plant profiles, which provide an overview of twelve selected wild plant species – including distribution and global conservation status. They also provide conservation and social risk profiles, each of which include a traffic-light rating indicating the risks related to the value chain, flagging to users the key issues they should be looking for. Opportunities for overcoming these risks, contributing to global conservation, and supporting livelihoods are highlighted in each profile, with common features for all wild-harvested plant ingredients summarized in the Conclusion. While the information is not intended to be exhaustive and does not replace on-the-ground fact-checking, it is hoped that making this information available in a simple, accessible manner will help users to begin navigating what are typically long and complex value chains.

ASSEMBLY OF THE PROFILES

Literature review

All information in the species profiles was assembled via literature review. The risk assessments are based on evaluation of the available literature. Profiles were compiled using peer-reviewed sources wherever possible. Other types of sources (for example market and price reports, news articles, personal communication with species experts) were also used where relevant and/or where peer-reviewed sources were sparse, as is the case for many of these species.

Information was compiled according to a template table that can be found in Appendix A. Where price data are included, inflation adjustment methods can be found in Appendix A. Note that all inflation adjustments have been conducted to 2020 values.

Biological risk assessment

"Some species, because of their reproductive biology, regeneration and growth strategies, or population structure, are inherently more able to withstand the continual perturbations of resource extraction than others." (Peters, 1994)

The susceptibility to over-collection is species-specific. Different species respond differently to the same collection pressures. The susceptibility or resilience is the overall potential of the target species to be managed on a sustained-yield basis.

Biological attributes such as distribution, regeneration and reproduction determine how resilient a given species is to collection pressure. For example, a species that exists only in one geographical region may be more susceptible to over-collection than a globally distributed one; a slow-growing species more susceptible than a fast-growing one.

Resilience can therefore be predicted by a small, well-chosen set of biological, threat, and trade attributes or factors. Nine factors constitute the biological risk assessment matrix. The attributes identified as risk factors are drawn from extensive field experience of numerous experts in plant ecology and sustainable wild harvest. They include factors related to the general biology of the species (intrinsic factors) and some external variables (extrinsic factors).

Information used in the biological risk assessment is drawn from published global, regional, and national sources, including pharmacopoeias, global and national conservation status assessments, and peer-reviewed as well as grey-literature publications, that can be accessed primarily through desk-based research.

Based on the available information, the state of each attribute of susceptibility or risk is classified on a three-level scale of Low (1), Medium (2), or High (3) Risk. Where information is lacking, the factor is classified as "unknown." In the next step, the assessments of each individual attribute are tallied up into an overall assessment using the same three-level scale of Low, Medium, or High Risk. This overall assessment is made according to a quantitative weighting to ensure that the system overall can be applied in a standardized way for all species.

The methodology used to make the biological risk classifications has been developed by the IUCN-SSC Medicinal Plant Specialist Group (MPSG), in consultation with the Technical Committee of the FairWild Foundation.[2] The biological risk assessments for the Wild Dozen profiles have been carried out by the IUCN MPSG. Further information on the biological risk assessment procedure is available on the FairWild website (see Leaman and Schippmann, 2021).

Social risk assessment

The social risk assessment tool evaluates risk against the nine sections of the Ethical Trading Initiative (ETI) Base Code, a universal code of labour rights widely used as a benchmark by businesses (ETI, n.d.). The Code was compared against the FairWild Standard to ensure that the specific labour context of wild harvesting was adequately covered. The two were compared against each other as follows:

	ETI BASE CODE	FAIRWILD STANDARD EQUIVALENT CRITERIA
1	Employment is freely chosen (no forced labour)	Fair working conditions for operation's workers
2	Freedom of association and the right to collective bargaining are respected	Fair working conditions for operation's workers Fair contractual relationships
3	Working conditions are safe and hygienic	Health and safety surrounding harvesting, processing, and trade
4	Child labour shall not be used	Limiting participation of children *FairWild best practice guidance used
5	Living wages are paid	Fair benefits for collectors and communities Sustainable buyer commitment
6	Working hours are not excessive	Fair working conditions for operation's workers
7	No discrimination is practiced	No discrimination against collectors
8	Regular employment is provided	Sustainable buyer commitment Fair contractual relationships
9	No harsh or inhumane treatment is allowed	Fair working conditions for operation's workers

TABLE 1

Comparison of the ETI Base Code against the FairWild Standard

[2] *The biological risk assessment procedure is used for FairWild risk assessments, in implementing the FairWild Standard version 2.0, where distinction is made between species considered to be at high, medium or low risk of unsustainable collection*

Evaluation against the ETI Base Code ties the assessment to the actual risks that may be present in supply chains (for example child labour, forced labour, unsafe working conditions), as well as the typical risks that businesses include in due diligence procedures. A wealth of information on each aspect of the Code can be found at www.ethicaltrade.org/eti-base-code. 'The Ethical Trading Initiative (ETI) is a leading alliance of companies, trade unions and NGOs that promotes respect for workers' rights around the globe.' As of October 2021, the ETI has 96 member companies worldwide with a combined turnover of more than GBP 166bn across various industries, from retail to construction to textiles to produce.
Social risk assessments are country- and species-specific. A risk rating has been produced for each top producing (or exporting, depending on the information available) country per species, aiming to cover at least 80 percent of global trade in the species.

A combination of country-level and species-level indicators have been selected to evaluate against each of the nine Base Code sections. All sources used are public and peer-reviewed wherever possible, as described in the Literature Review section. The country-level indices used can be found in References – Social Risk Assessment Methodology. Species-level findings are referenced throughout the species profiles, as well as in their accompanying biological and social risk assessment spreadsheets. The full assessment spreadsheets and methodology will not be published at this stage but will be retained for reference; please contact the authors at TRAFFIC International if further information is required.
Based on the available information, social risk is evaluated against each of the nine sections of the ETI Base Code on a three-level scale of Low (1), Medium (2), or High (3) Risk. Where information is lacking, the factor is classified as Medium (2). Guidance notes were developed for each of the Base Codes on what each scale level means in relation to wild harvest activities. In general, the risk scale is related to both the likelihood that a Base Code is not being met, and the severity of the worker rights violation that may be occurring through the Base Code not being met.

In the next step, the assessments of each of the nine Base Code attributes are summed up into an overall assessment using the same three-level scale of Low, Medium or High Risk, similar to the biological risk assessment.
The tool to conduct social risk assessments for the Wild Dozen profiles was created specifically for the Wild at Home project. The purpose of the tool is to provide a benchmark against which labour conditions and social risks can be measured within wild plant harvesting and processing. This evaluation is conducted at a high/generalist level – not specific to individual companies' supply chains – so that consumers and businesses interested in learning more about wild plant supply chains can use the results as a starting point of potential issues to investigate further.
The tool was built based on a knowledge of best practice in sustainability and ethical trade policies of food businesses and multi-stakeholder initiatives within the United Kingdom. In March-May 2021, it underwent two rounds of review with a range of non-governmental organizations (NGOs), inter-governmental organizations (IGOs), and industry colleagues, as well as TRAFFIC and FairWild Foundation staff.

Opportunities

There are two areas where opportunities to contribute towards a responsible, sustainable harvest are identified throughout the report. Firstly, a common set of opportunities that can be applied to all wild-harvested plant ingredients can be found in the Conclusion. Secondly, opportunities related to specific ingredients are identified throughout the Opportunities sections in the Wild Dozen profiles, and are based on the risk levels and types of each ingredient, as well as on the literature review. For ease of use, the opportunities have been categorized throughout the species profiles, and the categories are summarized below (note that the exact wording may be adjusted in profiles to accurately reflect the opportunities identified):

- **Research:** Scientific research is required to further understand and define what responsible harvest is.
- **Partnerships and associations:** Other organizations are working in the responsi-

ble harvesting space who can be aligned with or supported to further responsible sourcing efforts.

- **Conservation and restoration:** Protection or restoration efforts surrounding the focal species can contribute to broader-scale conservation or restoration efforts.
- **Standards and certification:** There are specific examples where standards and/or voluntary certification have supported sustainable trade.
- **Monitoring and data:** The ongoing collection of data related to a species and its trade, and the use of that data to monitor a species' health and manage its harvest, can contribute to its sustainable trade, including via international trade mechanisms like CITES.
- **Traditional knowledge, Intellectual Property Rights (IPR) and Access and Benefit Sharing (ABS):** Identifies where Indigenous Peoples and Local Communities (IPLCs) should be engaged with to negotiate fair and equitable agreements for the use of traditional knowledge. See further explanations throughout the profiles and in the Conclusion.
- **Health and safety:** Improvements can be made to the physical working conditions of harvesters or processors.

BOX 4

CHILDREN IN WILD HARVEST

Depending on the species, harvesting location, and harvesting community, children or young people may assist their families in wild-harvesting activities. This is not inherently negative; for example, many of us may have fond memories of collecting berries or fungi with our families during childhood, and the practice can allow for the passing-down of traditional knowledge. However, there are critical factors to consider in ensuring that children and young people are safeguarded against harm if children are detected in wild-harvest supply chains.

The following is an excerpt of guidance provided by the FairWild Foundation (2013). The FairWild Standard can also be used as a benchmark for good practice specific to wild-harvesting; see FairWild Foundation, 2010.

Child labour is regulated under various international conventions and recommendations, most prominently ILO Convention 138 (Minimum wage) and ILO Convention 183 (Worst forms of child labour). Children under the age of 15 shall not be employed as workers and hence may also not be contracted as collectors. Also young workers and hence young collectors (15-18 years) are protected by international law. If the collection operation contracts young collectors, great care must be taken to monitor that their work is not hazardous or may jeopardize their development or wellbeing.

The situation of children working in collection is more complex. As it is considered as a "non-industrial situation" under ILO conventions, there is some flexibility in international legislation for children older than 12 years. These children are permitted to engage in light non-hazardous work for limited times after school or during school holidays to earn pocket money.

In the case of children helping their families there is slightly more flexibility, as children even under the age of 12 frequently participate in collection during non-school hours. They are allowed to join in very light activities and help their parents. It is most crucial that all such activities of children must be analysed in detail and closely monitored / supervized by the collection operation to make sure that children never do substantial or hazardous work or work long hours, even under supervision of their parents. This work must under no circumstances jeopardize school attendance or successful education.

©Pixabay

Revisions

Following initial assembly of the Wild Dozen profiles, each was reviewed by between one and three TRAFFIC peer reviewers and two FAO reviewers. Reviewers were chosen based on a pre-existing knowledge of the species, region, or focus of the profile (for example experience in trade data).

Following the internal review, external comments were sought. Again, reviewers were chosen mainly based on a pre-existing knowledge of the species, ingredient, industry, or region. In many cases, these were authors of the peer-reviewed papers cited, highly-regarded members of industry groups (for example Global Frankincense Alliance), or national CITES Management Authorities.

Overall, each profile was reviewed by three to six external individuals or organizations, in addition to the internal review.

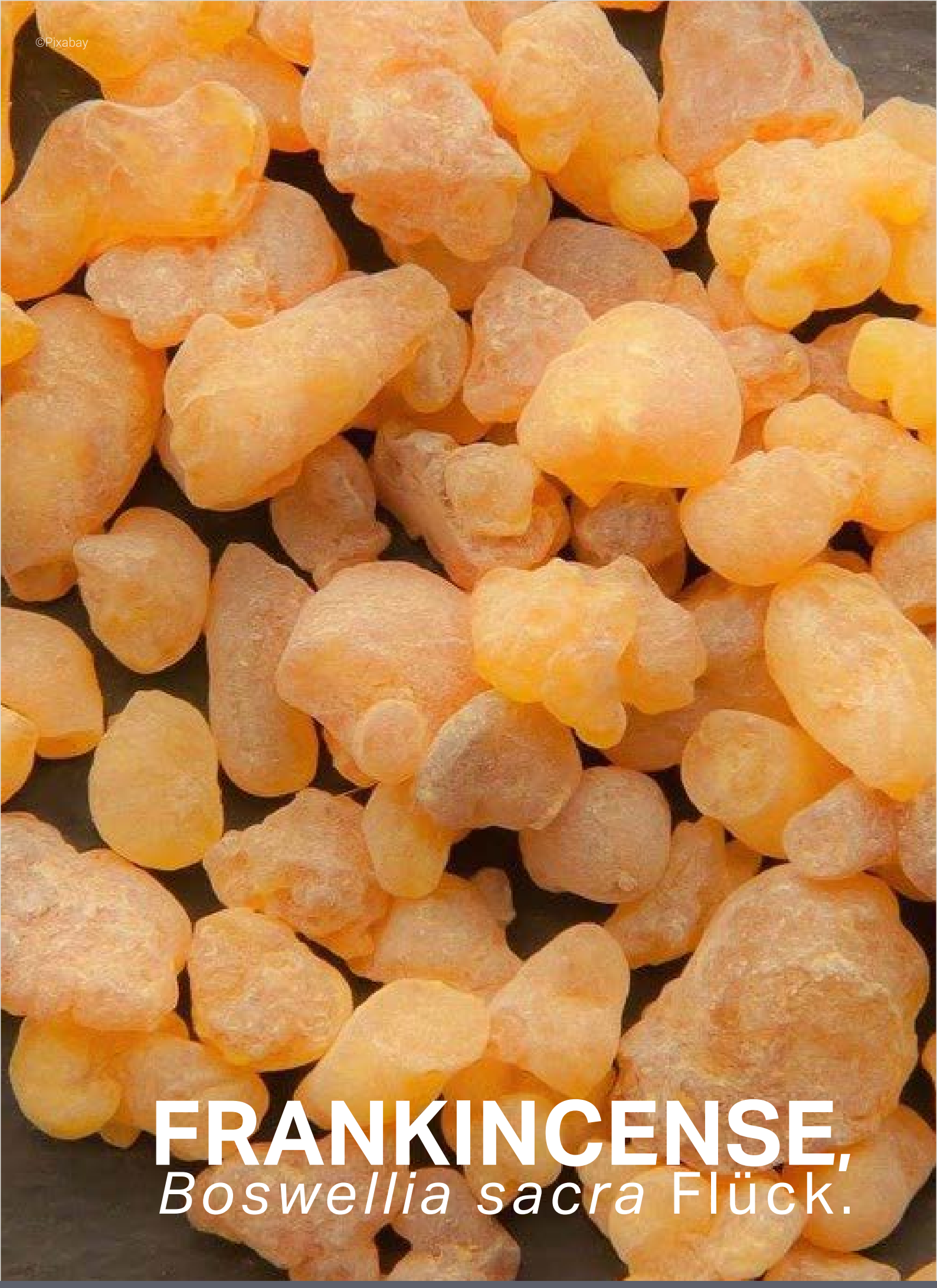
©Rachel Claire / Pexels

WILD DOZEN PROFILES

The subsequent profiles offer a summary of vital information related to production, trade, risks, and opportunities for twelve flagship wild-harvested ingredients. They provide a brief overview of each ingredient and the species from which it is sourced. Readers are encouraged to consult additional resources indicated in the profiles.

Although some ingredients can be derived from a number of species (see Frankincense as an example), a single species has been chosen as the focus for each profile to facilitate the biological risk assessments, which are conducted on individual species. Other species traded under the same common, or ingredient, name are referred to by their scientific names throughout the profiles, when relevant. It is advisable to review the Key Information table (see 'Name' for the focal species and 'Other relevant species' for other species referred to by the same common name) before delving into each profile.

The template for the design/format of these profiles can be seen in Appendix A. A summary can be seen in the Results Summary.



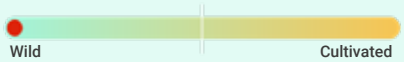
FRANKINCENSE,
Boswellia sacra Flück.

FRANKINCENSE, *Boswellia sacra* Flück.

NAMED IN INGREDIENTS AS

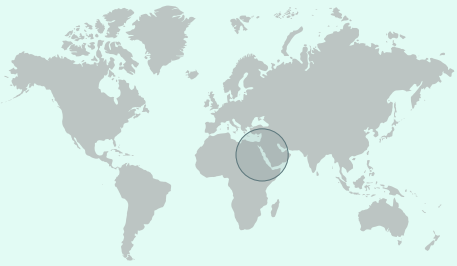
Frankincense, olibanum

WILD-HARVESTED VS CULTIVATED



Wild. *Boswellia* tree resin is collected almost entirely from the wild (Global Frankincense Alliance, *in litt*. to C. Schindler, 4 June 2021).

DISTRIBUTION



The centre of geographic distribution of the genus *Boswellia* is located in north-eastern parts of Africa, where more than 75 percent of its species are endemic to the area. *Boswellia sacra* grows in Oman, Somalia, and Yemen (RBG Kew, 2017).

GLOBAL CONSERVATION STATUS

IUCN: Lower Risk/Near Threatened (Oldfield *et al.*, 1998; IUCN, 2020). This assessment needs updating.

CITES: Not listed. In 2019, the CITES CoP 18 decision called for the collection of data on trade, status, and harvest levels of the Boswellia species with an aim to assess whether any of the species meet the criteria for listing under CITES (CITES, 2019).

PRODUCTS IT IS FOUND IN

Major uses of frankincense are for incense, aromatherapy, cosmetics, perfumery, and traditional medicine (Glatz, 2020; Alaamri, 2012; Global Frankincense Alliance, *in litt*., 4 June 2021). It is a popular fragrance and serves as the base ingredient in many perfumes and aftershaves (Alaamri, 2012).

OTHER RELEVANT SPECIES

Frankincense is an aromatic resin derived from tree species in the *Boswellia* genus (RBG Kew, 2017). There are 24 members of the genus *Boswellia*, distributed across north Africa and south-central Asia (Thulin, 2020). The most commonly traded species are *Boswellia papyrifera* Hochst., B. *serrata* Roxb. ex Colebr., B. *sacra* Flueck., and B. *frereana* Birdw. (Johnson et al., 2019).

Although this profile focuses on *Boswellia sacra*, there is limited information available in many cases, so other *Boswellia* species are referenced where noted.

PRODUCTION

Frankincense is considered one of the oldest commodities in the world and, in the Bible, was one of the gifts presented by the Wise Men to baby Jesus (Michie, 1989).

Frankincense is an aromatic resin derived from tree species in the *Boswellia* genus (RBG Kew, 2017). The resin is extracted from a 1mm deep incision, typically 3x4cm wide, cut through the bark into the underlying cambium, which then oozes the gum (Alaamri, 2012). The resin emerges as a milky juice and hardens on exposure to air (Alaamri, 2012). Half a kilogram of resin is collected from one tree per year on average (Al-Aamri, 2014). This appears to be roughly the same for all *Boswellia* species (Ali *et al.*, 2009; Cherenet *et al.*, 2020; Eshete *et al.*, 2012; Soumya *et al.*, 2019; Mishra *et al.*, 2012; Tilahun *et al.*, 2011).

In Oman, this extraction is done nine to eleven times annually, at intervals of 14-23 days, before re-tapping from the same area. The incision is expanded with each tapping round until it reaches a size of 6x10cm. The collection takes place only during the warm season, with no collections made during the rainy season (Alaamri, 2012; Global Frankincense Alliance, *in litt*., 4 June 2021). This is the same in Somalia, although Somalia experiences two rainy seasons, so there is sometimes a second harvest cycle during the winter dry season (Global Frankincense Alliance, *in litt*., 4 June 2021).

Resin is then sorted and graded according to size, colour, and purity (Alaamri, 2012). A large proportion of the resin today is distilled into essential oil; resin destined for distillation is often not sorted or graded (Global Frankincense Alliance, *in litt*., 4 June 2021).

For harvesters, **frankincense is typically an important source of income**. In 2016, it was estimated that 225 000 people in the **Republic of Somaliland** and the **Puntland State of Somalia** derived 57-72 percent of their income from frankincense harvesting and related activities. The reliance on frankincense was highest for the most impoverished families (UN FAO, 2016). In **Sudan**, harvesters tend to migrate from different regions of the country and typically have low levels of formal educational, although they can be particularly skilled at harvesting and processing frankincense resin (Abdalla and Gessmalla, 2018). In Dhofar, **Oman**, frankincense is considered a significant source of income and is an important export of the region (Alaamri, 2012).

Access to and management of frankincense-producing trees can pose a challenge for harvesters.

- In **Oman**, the frankincense trees are owned and managed by local kinship groups of herders, mainly grazing goats and sheep. Since the 1970s, the collection has been carried out mostly by migrants from Somalia, a neighbouring country, mainly due to the migration of herders to urban areas. In 1999, 95 percent of the Somalis living in Oman worked in tapping frankincense, which was nearly an exclusive source of cash income (Ichikawa, 2012).
- In **the Republic of Somaliland**, areas containing frankincense trees are divided into discrete, privately owned fields referred to locally as "farms"; these fields are owned by families and passed down the male line (DeCarlo *et al.*, 2020). Only the owners have the right to harvest the trees, although they often hire or lease to landless harvesters (*Ibid*.). Women in the territory are marginalized, typically without a formal education, with high levels of poverty, and not permitted to own or manage land (*Ibid*.).
- In **Ethiopia**, where other Boswellia species grow, communities own and manage the resource in some regions, whereas in others (for example Amhara Region), local community access to the resource is severely restricted, where only commercial producers with adequate capital are allowed to collect and sell gums and resins. There are no forest management plans or monitoring systems to ensure that gum collecting and exporting companies manage the forest responsibly (Lemenih and Kassa, 2011). However, current Ethiopian government policy has favoured moving toward community-based cooperatives, rather than concessions to private companies, so the situation may change in the near future (Global Frankincense Alliance, *in litt*., 4 June 2021).

½ KILO
The average amount of resin collected from one tree per year

225 000
people relied on harvesting frankincense for as much as 72 percent of their income

Samburu woman collecting Frankincense from the ground, Kenya © Colin Winter/Neal's Yard Remedies

TRADE

The top **producing regions** of *B. sacra* are North Somalia/the Republic of Somaliland/ the Puntland State of Somalia, South Yemen (Hadhramaut) and Oman (Dhofar) (Thulin and Warfa, 1987; RBG Kew Science, 2017).

Typical frankincense supply chains may involve multiple levels of middlemen, sorting houses, resin buyers, essential oil distilleries, exporters, and retailers (DeCarlo *et al.*, 2020). In the simplest cases, landowners or harvesters can sell directly to resin buyers or distilleries (*Ibid*.). The producing countries, including Yemen and Somalia, have suffered from many conflicts, which has impacted the frankincense trade. The resin from Somalia is usually exported to distilleries in the United States of America, the European Union, or United Arab Emirates, where it is distilled into essential oil (*Ibid*.).

In Somaliland, the traditional resin purchasing system requires the buyer to provide cash or food pre-payment to the harvesters and then collect the resin at the end of the season. However, sometimes operators fail to honour the contract by selling their resin to a different purchaser who bids more at the end of the season. Likewise, some traders do not pay the resin balance unless the harvesters agree to sell the following season's resins as well (DeCarlo *et al.*, 2020).

There is **no dedicated Harmonized System (HS) Code for frankincense, making it challenging to monitor its international trade**. Frankincense resin is traded under the HS code 130190 – "Lac; natural gums, resins, gum-resins and oleoresins (for example, balsams) other than gum arabic", which also includes other gums and resins such as myrrh. Trade volumes and values under this code for Yemen and Oman, two of the top-producing countries of *B. sacra, are captured in Table 2* and *Table 3* below. No data were available for Somalia, the third top-producing country. The export of frankincense extract is under the HS code 3301 30 – "Resinoids", while trade of frankincense essential oil is recorded under the HS code 330129, both of which are general codes that include ingredients other than frankincense (CBI, 2021a).

Prices of frankincense can be volatile, as demonstrated in the case of Sudan's export values in Table 4. In Sudan in 2016, the average production cost of the similar species *B. papyrifera* was approximately USD 3.75/tonne, while the local market price was about USD 9.00/tonne. The net return of frankincense was thus found to be USD 5.25/tonne on the Sudanese domestic market (Abdalla and Gessmalla, 2018). In June 2021, it was anecdotally reported by traders that the average price for Sudanese *B. papyrifera* in international trade ranged from USD 3 000 - 4 000/tonne (Global Frankincense Alliance, *in litt*., 4 June 2021).

YEAR	QUANTITY (KG)	TRADE VALUE (USD)	INFLATION-ADJUSTED TRADE VALUE (USD)
2011	457 388	344 842	396 771
2012	291 203	228 468	257 542
2013	291 203	No data	-
2014	340 778	253 658	277 310

TABLE 2

Export data under the HS Code 130190 from Yemen between 2011-2015, after which no data were available
Source: UN Comtrade, 2021.

YEAR	QUANTITY (KG)	TRADE VALUE (USD)	INFLATION-ADJUSTED TRADE VALUE (USD)
2011	139 368	1 189 055	1 368 114
2012	23 582	93 308	105 182
2013	17 501	83 326	92 574
2014	6 154	65 107	71 178
2015	366 055	1 841 703	2 011 054
2016	9 160	34 795	37 521
2017	47 710	1 676 410	1 770 045
2018	35 980	3 060 883	3 154 801

TABLE 3

Export data under the HS Code 130190 from Oman between 2011-2018
Source: UN COMTRADE, 2021.

YEAR	QUANTITY (TONNES)	AVERAGE PRICE (USD/TONNE, ORIGINAL FIGURES)	AVERAGE INFLATION-ADJUSTED PRICE (USD/TONNE)
2004	375	908	1 244
2005	358	2 028	2 688
2006	183	789	1 012
2007	76	746	931
2008	20	1 850	2 224
2009	Not available	Not available	Not available
2010	3	767	910
2011	1 794	1 159	1 333

TABLE 4

Quantities and prices of Sudan exports of frankincense from period 2004-2011
Source: Sudan Customs Police, Division of Export, 2012, cited in Abdalla and Gessmalla, 2018.

RISKS

biological risk

social risk

Somalia, Yemen and Oman

Biological:

Note that this profile focuses on *B. sacra*, as does the biological risk assessment. There is evidence that other *Boswellia* spp., such as *B. papyrifera*, are lacking in natural regeneration and at risk due to over-exploitation and ecosystem degradation, with the latter at risk of population collapse (Bongers *et al.*, 2019); however, a biological risk assessment has not been carried out on other Boswellia spp. at this time. A significant lack of data has been noted for *Boswellia* spp. – for example, in Somaliland, it is reported that no scientific field research on frankincense has been conducted since the 1980s (CITES, 2020). Further, the total annual frankincense harvest is unknown for all of its range States, across all *Boswellia* spp. (*Ibid.*) – so extra caution should be taken when sourcing frankincense, regardless of the biological risk assessment results. The IUCN Global Trees Specialist Group has prioritized updated Red List Assessments of all *Boswellia* species in its Assessment Initiative (CITES, 2020).

Biological risk level for *B. sacra* has been assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- The species' **geographic distribution is locally restricted** to northern Somalia and the woodlands of the escarpment mountains of the southern coast of the Arabian Peninsula (RBG Kew, 2017).
- The species is **adapted to a single specific habitat type**: mountainous desert-woodland habitats that are reached by coastal fog (RBG Kew, 2017; Thulin, 1998).
- It is facing **multiple threats**, including: land conversion for farming (Anon, 2010); wood harvesting for fuelwood (Anon, 2010); improper harvesting/tapping of trees (Anon, 2010; DeCarlo and Ali, 2014); and overgrazing by livestock (Anon, 2010; Brendler *et al.*, 2015). However, it is noted that some of these references refer to other *Boswellia* spp. or the genus as a whole rather than *B. sacra* specifically, and that further research is needed into the impact of these threats on *B. sacra*.

Social:

Assessed for **Somalia**, **Yemen**, and **Oman**, the main producing regions (Thulin and Warfa, 1987; RBG Kew Science, 2017), as **High** (Schindler, 2021), due to the following factors:

- The wider country context is important to consider in *B. sacra*'s range countries. In Somalia and Yemen, ongoing internal conflicts mean that there can be no guarantee of **worker rights**, 'due to the breakdown of the rule of law' (ITUC, 2020).
- This instability also means that both Somalia and Yemen have a high vulnerability to **modern slavery** (Walk Free Foundation, 2018).
- **Child labour** has been recorded in similar farming activities like harvesting dates in Somalia and Yemen (USDoL, 2019), although no cases specific to frankincense have been identified. Oman is more stable and therefore has lower (although not insignificant) risks of modern slavery and violation of workers' rights; however, it also has documented cases of child labour in similar farming activities (USDoL, 2019; Alaamri, 2012).
- Frankincense harvesting can be some **vulnerable** families' main earning activity, meaning that they are at the mercy of price fluctuations and resource availability (Alaamri, 2012; DeCarlo *et al.*, 2020).
- In the Republic of Somaliland, women are traditionally **discriminated** against in land ownership and therefore management of the resource (DeCarlo *et al.*, 2020).

It is important to note that the Republic of Somaliland, an important region for frankincense production, has not been formally recognized as a country by the UN. Therefore, the risk indices reviewed for modern slavery, child labour, corruption, and worker rights were for Somalia, in which Somaliland is included. However, Somaliland is known to have been more stable in recent years than the rest of Somalia and therefore may differ in its social risk (BBC News, 2017).

OPPORTUNITIES

Although there are significant risks associated with sourcing frankincense, including B. sacra, there is also a much-needed opportunity to support livelihoods within vulnerable regions where few other earning opportunities may exist.

Research

There is a significant lack of data for Boswellia species (CITES, 2020). Supporting harvesters to collect and share data on the annual harvest (for example timings, locations, species, tonnages, techniques) can contribute to better resource management.

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. The FairWild standard, for example, designed to be applied to wild-harvested plant ingredients, has been applied in frankincense harvesting at small scales in Kenya and Somaliland; see FairWild (n.d.) for certified frankincense. Organic certification has also been applied to frankincense: two companies are currently certified to produce organic resins in Somaliland and Somalia to United States Department of Agriculture National Organic Program standards and experience economic benefits from the certification (Johnson *et al.*, 2019; USDA, 2021).

Partnerships and associations

Engaging with local groups, NGOs, and other businesses operating in the industry or region provides an opportunity to support sustainable harvesting techniques and community development on a more impactful scale. The Global Frankincense Alliance is an association working towards the conservation and sustainable development of frankincense and myrrh. See https://globalfrankincensealliance.com/

Conservation and restoration

Protection of existing frankincense trees, sustainable harvesting, and planting of additional trees can support conservation of other important local species that live amongst or rely on them, as well as contribute towards broader landscape-scale efforts.

- Frankincense trees share their habitat in Oman with the critically endangered

Frankincense resin © Colin Winter/ Neal's Yard Remedies

Arabian leopard *Panthera pardus* nimr; the leopards are similarly threatened by desertification and livestock overgrazing (Karáth, 2016).

- Sweet-smelling frankincense flowers are important for honeybees and local honey production (Abdalla and Gessmalla, 2018).
- In the Sahel region, various tree species are being used to halt the expansion of the Sahara desert through the Great Green Wall Project, which aims to create a new forest spanning the African continent east to west from Dakar to Djibouti (Gray, 2019). FAO's Action Against Desertification initiative has identified 35 species of resins and gums, including frankincense, as potential producers of commercial gums and resins with potential to support both landscapes and livelihoods in the Great Green Wall core area that spans some eleven countries (Sacande and Parfondry, 2018).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

Frankincense Harvesters in the Samburu region, Kenya ©Colin Winter/Neal's Yard Remedies

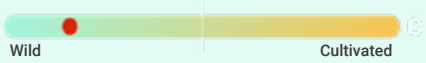
PYGEUM, *Prunus africana* (Hook.f.) Kalkman

PYGEUM, *Prunus africana* (Hook.f.) Kalkman

NAMED IN INGREDIENTS AS

Pygeum, *Prunus*, African cherry, red stinkwood, African almond

WILD-HARVESTED VS CULTIVATED



Mainly wild. Wild populations of *P. africana* trees are crucial to the international trade of its bark for medicinal purposes: over 99 percent of direct exports of *P. africana* (as reported by exporters to CITES between 2007 and 2016) were sourced from the wild (CITES Trade Database, 2021).

DISTRIBUTION

Distributed in montane forests across tropical Africa. Its natural range extends from Nigeria in the west to Ethiopia in the east, and south to South Africa, also to the Comoros and Madagascar (RBG Kew, 2021; Sunderland & Tako, 1999).

GLOBAL CONSERVATION STATUS

IUCN: Vulnerable, needs updating (Oldfield *et al.*, 1998).

CITES: listed in **CITES Appendix II** since 1995, including all parts and derivatives except seeds, spores, pollen, seedling or tissue cultures, cut flowers of artificially propagated plants, fruits, fruit parts and derivatives.

PRODUCTS IT IS FOUND IN

The primary use of Pygeum is **for medicines and herbal products to treat prostate conditions in men** (Bodeker *et al.*, 2014). This medicinal use is the main driver of international trade.

OTHER RELEVANT SPECIES

Like *P. africana*, issues related to access and benefit sharing (ABS) apply to many wild collected species. For example, Devil's Claw (*Harpagophytum procumbens* and *H. zeyheri*), is traditionally used by the San and Khoikhoi peoples in Southern Africa to treat a range of ailments, while it is also sold in international markets to relieve articular pain and stimulate appetite. ABS mechanisms are in place to ensure local and indigenous communities continue to benefit from their traditional knowledge of the root. More than 90 percent of the global supply of Devil's Claw root comes from wild collection, mostly by rural communities in Namibia (Engels and Brinckmann, 2018).

PRODUCTION

Prunus africana is an evergreen tree that grows across tropical Africa and is an important food source for rare and endemic birds and primates, including red colobus and black and white colobus monkeys (Cunningham *et al.*, 2015). It is exploited primarily for the medicinal properties of its bark. The accepted "sustainable" method of collecting Pygeum from wild *P. africana* trees involves stripping two quarters of the bark (on opposite sides) from the living Pygeum tree, then leaving the tree to regenerate (Ekane, 2006). However, this is not necessarily applied (Nkeng *et al.*, 2010), nor has the sustainability of the two-quarters practice been proven (Sunderland, 2016).

Some cultivation of Pygeum has occurred since the 1970s; however, there is little commercial incentive for farmers to grow Pygeum, as low prices are offered to primary producers (Bodeker *et al.*, 2014). Cunningham *et al.* (2015) suggest that the most sustainable and economically viable method of Pygeum production would be to cultivate *P. africana* trees exclusively for felling, which would allow harvesting of 100 percent of the bark as well as the opportunity to sell the remainder of the tree as timber and fuel.

In areas like Mt Cameroon in the southwest of Cameroon, the bark harvesting is often carried out by local people (Cunningham *et al.*, 2015). Around Mt Cameroon, unions of Pygeum harvesters have been formed to facilitate sustainable harvesting and improved livelihoods for local communities (Ekane, 2006). In Tanzania, socioeconomic profiling of harvesters in 2009 provided insights into Pygeum harvesting communities: it was found that that there were more men than women among harvesters, that the average age was 57, that harvesters typically had larger families (10 people) than the national average (4.9), and that there was a higher percentage of people with primary level education among Pygeum harvesters (68 percent) than the national average (41 percent) (Maximillian and O'Laughlin, 2009). Further research is required to understand the socioeconomic profiles of harvesters across the range of this species beyond the examples cited here.

Typically, bark harvesters are paid a fraction of the market value of the bark, and the bulk of the value is captured by a small number of exporting companies with a monopoly on CITES export permits (Cunningham *et al.*, 2015). Instead, bark harvesters reportedly rely on diversified livelihood strategies, including collection of other NWFPs or farm production (*Ibid.*).

Harvesters rely on **DIVERSIFIED LIVELIHOOD STRATEGIES**, as they do not earn enough from pygeum harvesting alone

Prunus Africana © David J. Stang/ Wikimedia Commons

TRADE

CAMEROON, UGANDA, DEMOCRATIC REPUBLIC OF THE CONGO
are the top producers of pygeum

Between 2011 and 2019, international trade of Pygeum was reported to be dominated by exports from Cameroon, Uganda, and the Democratic Republic of the Congo (DRC). During this time, Cameroon was reported to have exported the greatest volume of Pygeum by a significant margin. Spain, France, Madagascar, and Belgium were reported to be the most significant importers (CITES Trade Database, 2021).

Harvesters typically either sell the bark directly to pharmaceutical companies, or sell to middlemen who, in turn, sell to a small number of pharmaceutical companies that dominate the international trade of Pygeum (Cunningham *et al.*, 2015). These large companies export the bark in a dried or powder form for processing into pharmaceutical products in Europe (Bodeker *et al.*, 2014). Price surveys echo this imbalance and suggest the value chain of Pygeum is heavily captured by a small number of exporters who earn approximately USD 6/kg (Cunningham *et al.*, 2015). Harvesters are paid a fraction of this, with reports of earnings as little as USD 0.33/kg (Cunningham *et al.*, 2015). A study in Cameroon found cases where prices paid to harvesters of Pygeum were as low as USD 0.10/kg in 2005 (Awono *et al.*, 2016).

Between 2011 and 2019, approximately 8.6 million kilograms of Pygeum was reported in exports, the majority of which was from wild sources (CITES Trade Database, 2021). Total exports from 2011 to 2019 from the top three international exporters of Pygeum are shown in Figure 1.

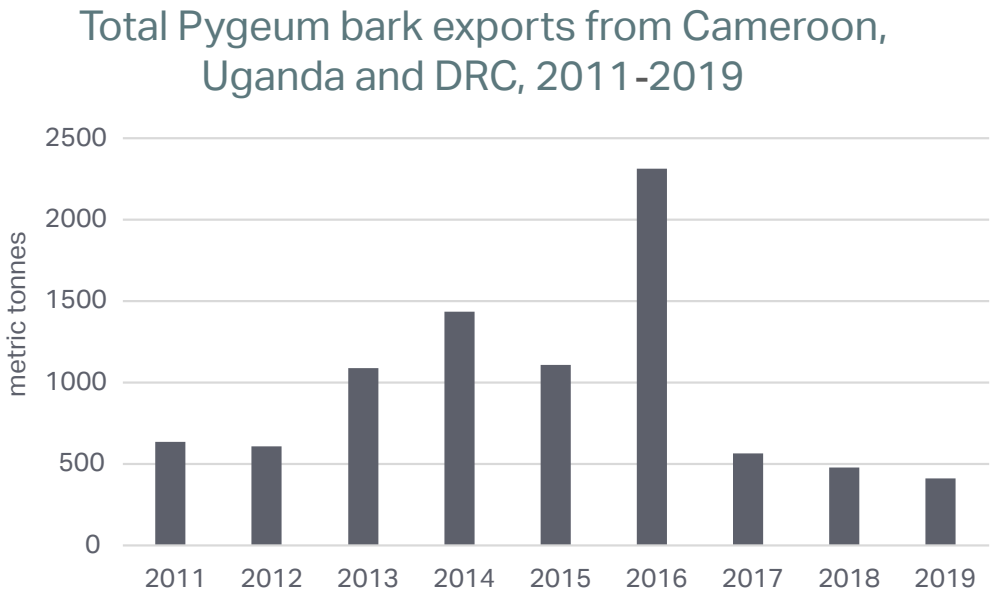


FIGURE 1
Source: CITES Trade Database, 2021.

RISKS

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- Its conservation status has been assessed globally as **Vulnerable** (Oldfield *et al.*, 1998).
- It is harvested primarily for its bark (Cunningham and Mbenkum, 1993) and can therefore be **destroyed through collection**.
- **Local population sizes are small and scattered thinly** throughout its range (Stewart, 2003; Stewart, 2009).
- It is facing a **single threat** across its range, namely the harvesting of its bark. The exploitation and poor regeneration in many parts of its afromontane range have led to dramatic reductions in its population in many countries of its range (Stewart, 2009; Cunningham *et al.*, 2015).

Social:

Assessed for Cameroon, Uganda, and the Democratic Republic of Congo, the top exporting countries between 2008-2016 (CITES Trade Database, 2021), as **High** (Schindler, 2021), due to the following factors:

- The main countries in which Pygeum is harvested and exported are highly vulnerable to **modern slavery** and have multiple documented cases of **child labour** in similar agricultural activities such as cocoa, tea, and vanilla harvesting and processing (USDoL, 2019 and 2020; Walk Free Foundation, 2018). However, none of these cases has been identified specifically in *P. africana* harvesting or processing.
- These countries also experience fairly high levels of inequity associated with **corruption**, and **workers experience systematic violations of their rights** to freedom of association and collective bargaining (Transparency International, 2021; ITUC, 2020).
- There is evidence of **low pay** amongst Pygeum harvesters, and women can be excluded from participating in the harvest (Cunningham *et al.*, 2015; Ingram *et al.*, 2015; Ekane, 2006; Maximillian and O'Laughlin, 2009).
- Concerns have been raised about the lack of respect for **indigenous rights** over the pharmacological knowledge of Pygeum as a medicinal plant (Bodeker *et al.*, 2014), as well as concerns about whether **local communities** benefit from the trade in Pygeum based on reports that in some areas harvesters come in from outside the local area to harvest the bark (Cunningham *et al.*, 2015), as well as on the **low wages** reportedly received by harvesters (Cunningham *et al.*, 2015; Awono *et al.*, 2016).
- There are suggestions of **corruption** in bark harvesting, with reports of "bark poachers" using bribery to persuade local communities to grant access to the trees (Page, 2003).

MEDIUM

biological risk

HIGH

social risk

Cameroon, Uganda, and the Democratic Republic of Congo

Pygeum bark powder

OPPORTUNITIES

Although there are risks associated with Pygeum, there are also opportunities to support livelihoods across a range of vulnerable regions in Africa where few other earning opportunities exist, while financing conservation of this vulnerable CITES-listed species.

Research

Support scientific studies into sustainable Pygeum harvest methods to improve the wild harvest and provide evidence for best-practice methods. Meanwhile, it may be possible to purchase Pygeum from sustainable cultivated sources and to support cultivation trials, to reduce pressure on wild populations which currently make up the bulk of exported bark (Cunningham et al 2015).

Conservation and domestication

Engage with local groups/NGOs and other businesses operating in the field of conservation – encouraging research into sustainable harvesting or cultivation methods and frequencies while protecting (or re-planting) the surrounding forest to discourage grazing animals, considered best practice (Cunningham *et al.*, 2015). This can alleviate pressure on wild stands and support the rare and endemic birds and primates that access *P. africana* as an important food source, including the red colobus and the black and white colobus monkeys (Cunningham *et al.*, 2015). Incentivize domestication - generally understood as the most viable option to sustain future trade and local livelihoods - and separate supply chains for cultivated bark, including supporting market access for local producers (Cunningham *et al.*, 2015). The World Agroforestry Centre has produced a guide on Agroforestry Tree Domestication (2012) which may be a helpful resource.

Monitoring and data

Encouraging rigorous monitoring systems, adherence to regulations, and adoption of best practices can support conservation, long-term sustainable use, and contribution to livelihoods. The case of *P. africana* underlines the invaluable role that monitoring, evaluation, and institutions such as CITES (and associated national or international entities) can play in governing sustainable trade of wild products, as well as the importance of suspensions and quotas for wild specimens when necessary.

Traditional knowledge, IPR and ABS

ABS agreements may contribute to the sustainable exploitation and use of wild products such as *P. africana*. The Southern Africa Network for Biosciences (SANBio)/New Partnership for Africa's Development (NEPAD) guidelines, for example, exist to facilitate the development and implementation of policies and legislation for the protection and management of IPR, traditional knowledge, and ABS (Bodecker *et al.*, 2014). Industry stakeholders should become familiar with these terms, as well as how they pertain to, and can be respected through, pygeum supply chains.

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. A wide range of standards are available that can be applied to wild-harvested plants, such as organic, PEFC, FSC, Geographical Indication, FairWild, UEBT, FairTrade, and Fair for Life. The FairWild Standard has been demonstrated to be best suited among relevant sustainability standards to certify CITES Appendix-II listed wild-sourced medicinal and aromatic plant species (Timoshyna *et al.*, 2019). Standards can also provide a best-practice guide on implementing IPR and ABS elements.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

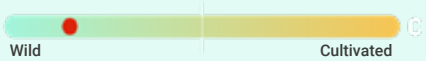
SHEA,
Vitellaria paradoxa
C.F.Gaertn

SHEA, *Vitellaria paradoxa* C.F.Gaertn

NAMED IN INGREDIENTS AS

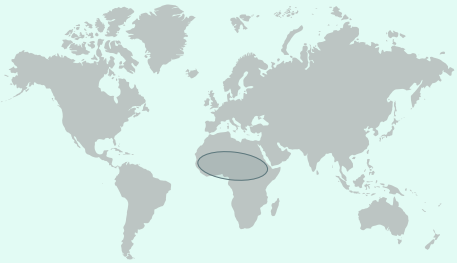
Shea butter, karite, *Butyrospermum parkii*, in chocolate as "vegetable fats (shea)"

WILD-HARVESTED VS CULTIVATED



Mostly Wild although some trees are purposely planted or selectively protected (ICRAF, 2021).

DISTRIBUTION



The range of Shea stretches across Africa from Uganda to Senegal in a 'shea belt' approximately 6000 km long and 500 km wide (Hall *et al.*, 1996). Generally, Shea is found in dry savannah and woodland (Makerere University Institute of Environment and Natural Resources, 1998) and is a recognisable part of Sudano-Sahelian savannah vegetation (Gwali *et al.*, 2012).

GLOBAL CONSERVATION STATUS

IUCN: Vulnerable, needs updating (Makerere University Institute of Environment and Natural Resources, 1998).

CITES: Not listed

PRODUCTS IT IS FOUND IN

Globally, there is a large market for Shea as a cocoa butter equivalent (CBE), which is used **mainly in the manufacture of chocolate** as a less expensive substitute for cocoa butter (Bello-Bravo *et al.*, 2015; Nahm, 2011). It is also popular **as a moisturizer** in products like hand creams, facial moisturizers, and hair products (Nahm, 2011). In West and East Africa, shea butter is used as an edible cooking oil (Hatskevich *et al.*, 2011).

OTHER RELEVANT SPECIES

Shea trees are often found in agroforestry parklands along with other selectively protected local tree species (Bockel *et al.*, 2020). Recently, other tree crops with similar characteristics such as *Balanites aegyptiaca* have been attracting attention due to their multiple benefits for dryland restoration, as well as for income generation due to their use in food, cosmetics, and medicine (Sacande and Parfondry, 2018; FAO, n.d.).

PRODUCTION

Shea are slow-growing multipurpose trees that grow in agroforestry parklands, dry savannahs, and forests in a 6000km belt stretching east to west, from Uganda to Senegal (IPGRI, 2006, cited in Bockel *et al.*, 2020; Hall *et al.*, 1996).

Shea trees begin to fruit at around 15 years, reach full productivity around 45 years, and can live for 200-300 years (Boffa, 2015, and Höfer, 2009, cited in Bockel *et al.*, 2020). The kernel (nut) is the source of shea butter.

BOX 5

AGROFORESTRY PARKLAND

Agroforestry parkland is a popular farming system in semi-arid West Africa and Sahelian countries, where selected trees are kept by farmers and therefore end up scattered amongst farmland and protected; for example, from bushfires (Boffa, 1999, and Nikiema, 2005, cited in Bockel *et al.*, 2020). The semi-domestication of agroforestry species can improve the livelihoods and the nutritional status of the local population, as well as the conservation of shea (Watson, 2016).

Parkland, Mali © Ake Mamo / Flickr

Harvesting of shea nuts is seasonal, and harvest patterns vary between countries. In Ghana, shea trees start flowering in November, and the harvest period begins in April and continues to August (Hatskevich *et al.*, 2011). Typically, shea nuts are collected, boiled, dried and de-husked, cleaned, and stored in jute sacks (CBI, 2015). The nuts are then transferred to local processing plants to convert into shea butter, or to exporters who export the nuts to Europe where they will be processed into shea butter. It has been reported that West Africa currently has the capacity to covert approximately half its shea crop into butter, and the volume of shea being processed into butter before export has been increasing (CBI, 2015).

Shea butter is produced primarily by women in many countries in West Africa, contributing to the incomes of an estimated 3 million women (Chen, 2017). It plays a vital role in poverty reduction and improving livelihoods, particularly for women and other vulnerable groups, because little investment is needed to harvest or enter the market (Adams *et al.*, 2016; Adedokun *et al.*, 2016; Bockel *et al.*, 2020; Hatskevich *et al.*, 2011; Solomom *et al.*, 2018). Although the role of shea in poverty alleviation is likely to vary across its range, in Ghana, the monthly income of shea nut harvesters was found to be 73 percent higher than the national average income (Hatskevich *et al.*, 2011).

Shea nut harvesting and processing can play an important role in

FEMALE EMPOWERMENT AND POVERTY ALLEVIATION

Shea butter production ©Axel Fassio/CIFOR

There can be
HEALTH & SAFETY AND CHILD LABOUR RISKS
in shea butter production

In Burkina Faso, shea nut was found on average to contribute 12 percent of household income to the poorest households (Pouliot and Elias, 2012).

Shea harvesters can face several hazards throughout collection and processing. A study conducted with women from several shea production groups in Northern Ghana highlighted difficulties with poisonous snake bites and other animal bites, getting cut by surrounding vegetation when accessing the trees, and having to walk long distances to access water and firewood needed for processing, as well as the nut-grinding machine (Naami and Naami, 2019). Elsewhere, there are informal reports of burns, injuries, and asthma due to the typical processing method of cooking and frying the nuts over an open fire before grinding them into a paste (Adu, 2016). There is variation in how accessible shea butter production is to different households. Studies in Burkina Faso have shown that it is easier for women with large landholdings, multiple shea trees, or access to transportation to collect the nuts. Meanwhile, the physically demanding nature of the shea butter production means that older women are precluded from production, while often younger members of the family like unmarried daughters are more involved (Pouliot and Elias, 2013).

Research in Mali found that children were used as workers to collect and process shea nuts (ICCO, 2016). Beyond Mali, other child labour cases in shea have not been identified; however, child labour may be involved in shea nut picking and processing in other regions, considering child labour cases found in similar agricultural commodities in the main shea producing countries of Ghana, Burkina Faso, and Cote D'Ivoire (USDoL, 2019; USDoL, 2020). Corruption is also an issue for the shea trade, with one study on cashew and shea trade in West Africa suggesting that corruption and bribery could account for up to 30 percent of transport costs of these goods (Bromley and Foltz, 2011). It has been suggested that a decrease in the costs associated with corruption could lead to increases in the prices paid to harvesters (Bromley and Foltz, 2011).

Shea butter production process ©Axel Fassio/CIFOR

TRADE

Between 2007-2017, Benin, Burkina Faso, Côte d'Ivoire, Ghana and Mali were the biggest reported exporters of shea according to export data (ITC Trademap Database, 2020). Of these, Ghana was said to be the biggest exporter (*Ibid*.). No data were available after 2017 at the time of research.

Most exported shea products are in the form of raw nuts. However, the proportion of processed shea butter products exported has increased from around 3 percent in 2001 to around 35 percent in 2010, and may continue to rise (Rousseau *et al.*, 2015).

A small number of large exporters often control the shea trade chains. In Burkina Faso, three major companies – AAK, IOI Loders Croklaan, and 3F – dominated the export of shea for its main market as a cocoa butter equivalent. These exporters have contracts with an estimated 2-15 wholesalers, which finance smaller traders, which in turn finance small retailers who buy nuts from the harvesters (Rousseau *et al.*, 2015).

Between 2007 and 2017, a reported 14 million tonnes of shea nuts were exported from six African countries (Benin, Burkina Faso, Côte d'Ivoire, Ghana, Mali and Nigeria) (ITC Trademap Database, 2020). The most significant reported exporter of shea nuts was Ghana, which reported 11.5 million tonnes, a volume that made up approximately 82 percent of the global trade in shea nuts between 2007 and 2017 (*Ibid*.).

Denmark was reported to be the largest importer, receiving 85 percent of reported shea nut exports (ITC Trademap Database, 2020). However, these figures are likely to underestimate total trade volumes, as many countries do not report shea nuts under a specific code, making it difficult to follow the trade in this commodity.

Shea prices fluctuate across the course of a year, with studies in Burkina Faso reporting harvesters selling shea nuts at USD 0.25/kg (XAF 125/kg at 15 March 2013 exchange rate, supplied by author; adjusted for inflation, USD 0.27/kg) at the start of the season (March 2013) to USD 0.42/kg (XAF 214.29/kg at 29 May 2013 exchange rate, supplied by Rousseau *et al.*; adjusted for inflation, USD 0.47/kg) at the end of the season (May to June 2013) (Rousseau *et al.*, 2015). For refined shea butter, which is usually used in cosmetic products, higher prices are paid. Prices for refined shea butter that is both organic and fair trade certified are higher than conventional (CBI, 2015). Fairtrade shea butter can provide producers with a significant premium, with certified producers in Burkina Faso in 2005-2006 selling the butter for USD4.96/kg (adjusted for inflation, USD 6.37/kg), compared with the USD3.11/kg (adjusted for inflation, USD 3.99/kg) offered to other sellers (Pouliot and Elias, 2013; original values were in XAF and converted by Pouliot and Elias into USD at a rate of XAF 242.42 per USD for data dating to 2005, and XAF 240.32 per USD for data dating to 2006).

GHANA
is the biggest exporter of shea nuts

DENMARK
is the largest importer

RISKS

MEDIUM

biological risk

HIGH

social risk

Ghana, Burkina Faso, and Cote d'Ivoire

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- The species was classified as **Vulnerable** on the IUCN Red List (Makerere University Institute of Environment and Natural Resources, 1998).
- **Regeneration**: It is slow-growing (Plants for a Future, n.d.) and depends on natural regeneration (Agossou Djossa *et al.*, 2008).
- It is facing **multiple threats.** The main threat causes are overexploitation for timber, charcoal production (Salako *et al.*, 2017), agricultural encroachment, and increasing human population pressure (Makerere University Institute of Environment and Natural Resources, 1998). Climate change could negatively affect the trees' productivity (Dimobea, 2020).
- It has several uses, including internationally for cosmetics and food, and domestically for food and medicine (Plants for a Future, n.d.). **Demand is growing** and trade will likely increase (Prota4u, n.d.; Byakagaba *et al.*, 2011).
- It is **regionally restricted** to the 'shea belt' in tropical Africa (Hall *et al.*, 1996), and is **adapted to few habitat types**, namely dry savanna and woodland (Makerere University Institute of Environment and Natural Resources, 1998).

Social:

Assessed for **Ghana, Burkina Faso,** and **Cote d'Ivoire**, the top exporters of shea from 2007-2017 (ITC Trademap Database, 2020), as **High** (Schindler, 2021), due to the following factors:

- Although there were no direct cases found in the top shea producing countries profiled here, it is possible that child labour is involved in shea nut picking and processing, considering **child labour** cases found in Mali and in similar agricultural commodities in these countries (ICCO, 2016; USDoL, 2019; USDoL, 2020).
- Shea presents an excellent opportunity for female empowerment and community development; however, there are **discrimination** and access rights issues that need to be addressed to advance these opportunities on a larger scale, such as permitting women to own and manage the land that shea trees are located on (Kent, 2018; Naami and Naami, 2019; Ingram *et al.*, 2015).
- **Health and safety** in the labour-intensive picking and processing is also a priority, including immediate dangers (for example, poisonous snake bites) and longer-term illnesses (for example, asthma resulting from the fires used to process shea) (Naami and Naami, 2019; Adu, 2016).

Shea trees ©Axel Fassio/CIFOR

OPPORTUNITIES

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. FairTrade shea butter is relatively abundant, although mainly concentrated in the cosmetics sector, and has been demonstrably beneficial in terms of the prices paid to harvesters and processors (ICRAF, 2021; Pouliot and Elias, 2013; Rousseau *et al.*, 2015). There is also an international food standard (Codex Alimentarius) that has been established for unrefined shea butter: see FAO and WHO, 2020. This can be used as a tool to standardize the quality of unrefined shea butter and support harvesting communities to gain access to wider international markets. A variety of standards are available that can be applied to wild-harvested plants – see Conclusion.

Partnerships and associations

Engage with local groups, unions, or NGOs working in shea-producing regions, such as the Shea Butter Union and the Global Shea Alliance, to ensure that any action taken to address risks in shea supply chains is meaningful and beneficial for producer communities.

Conservation and restoration

Protection of existing shea trees and the planting of additional ones can address biological risks, protect local livelihoods, support community development and fairer wages, and even conserve the shea caterpillars, an important edible insect for the nutrition and income of many farmers in the shea belt region (Payne *et al.*, 2019). Shea reproduction is highly dependent on insect pollinators, so encouraging a wider diversity of pollinators could improve shea nut production (Delaney *et al.*, 2020). Shea trees can also contribute to restoration (for example the Great Green Wall Project, which aims to create a new forest spanning the African continent east to west from Dakar to Djibouti as well as income-generating opportunities (Gray, 2019).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do

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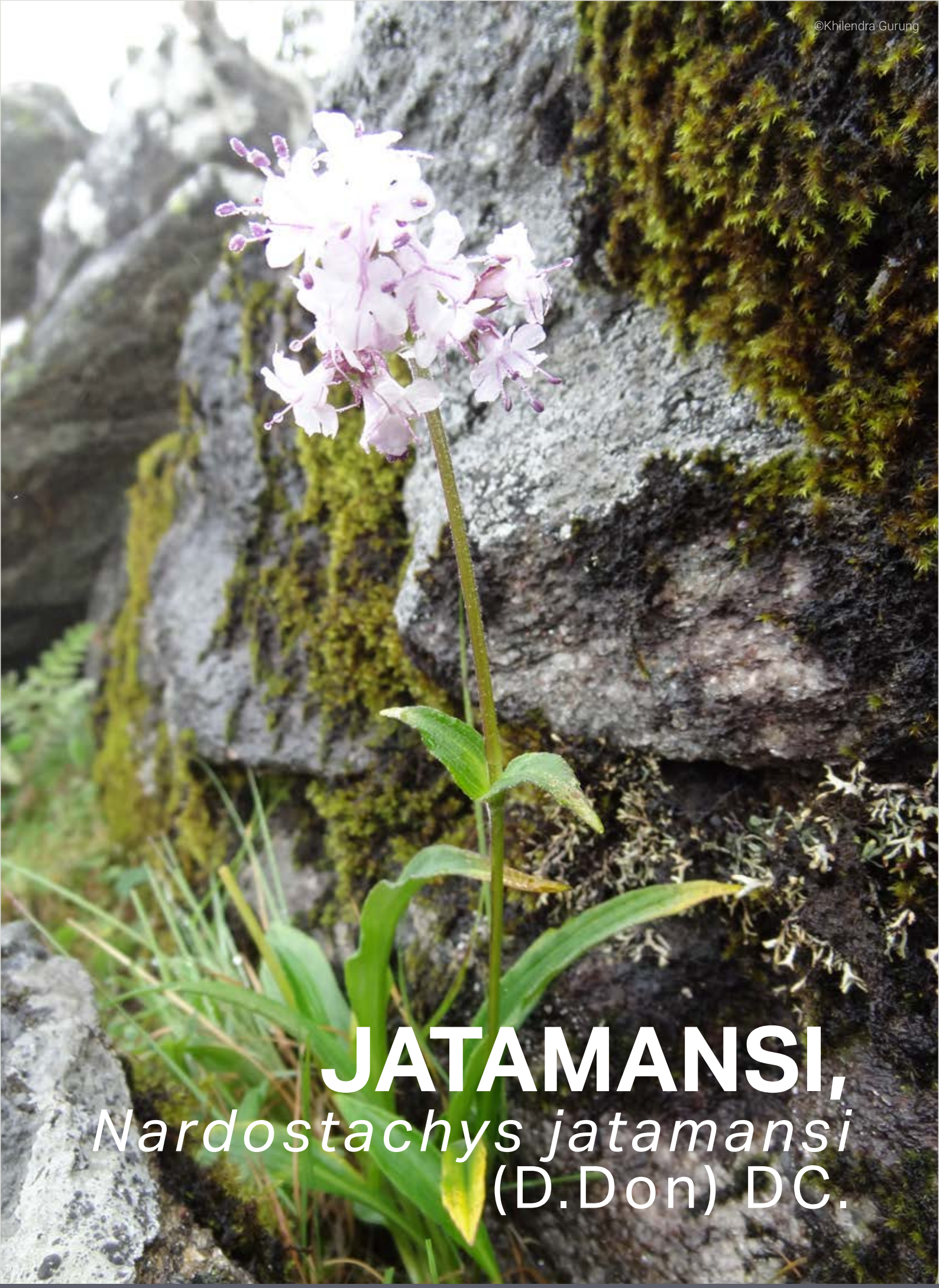


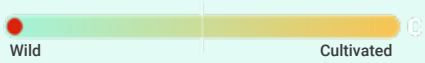
JATAMANSI,
Nardostachys jatamansi (D.Don) DC.

JATAMANSI, *Nardostachys jatamansi* (D.Don) DC

SYNONYM: Nardostachys grandiflora

NAMED IN INGREDIENTS AS: Jatamansi, Spikenard, Nard, Akasamamsi, Baalchad, Centu (Schippmann and Leaman, 2021)

WILD-HARVESTED VS CULTIVATED



Wild, with negligible amounts coming from cultivation (Larsen and Olsen, 2008).

DISTRIBUTION

Jatamansi is distributed throughout the Himalayan mountain range, which passes through India, Nepal, China, Myanmar and Bhutan (Larsen and Olsen, 2008, Singh *et al.*, 2013, and Ved *et al.*, 2015, cited in UNEP-WCMC, 2017).

GLOBAL CONSERVATION STATUS

IUCN: Critically Endangered (Ved *et al.*, 2015). This status is being reassessed (Chauhan *et al.*, 2021).

CITES: listed in CITES Appendix II since 1997.

PRODUCTS IT IS FOUND IN

Jatamansi is primarily used for medicinal purposes, with smaller amounts being used for aromatherapy and cosmetics (Purohit *et al.*, 2012). There is a long history of Jatamansi being used in traditional medicines, including Ayurveda, Unani and Chinese systems. In the Ayurveda system, both rhizomes and roots are used to treat a variety of mental health conditions like epilepsy and hysteria (Disket at al., 2012). Roots are also used to produce essential oils, which are believed to have a range of medicinal effects, including anti-bacterial and anti-fungal (Disket *et al.*, 2012).

OTHER RELEVANT SPECIES

Although a separate species, *Valeriana jatamansi* can also be traded locally in Nepal as Jatamansi or as Sugandhawal. It is mixed with *N. jatamansi* for medicinal use in both Traditional Chinese Medicine (TCM) and Traditional Tibetan Medicine (TTM) (Z. Ke, TRAFFIC, *in litt*. to C. Schindler, 14 May 2021).

Nepal's alpine meadows house other, similar high-value medicinal species including *Kutki Neopicrorhiza scrophulariiflora* and *yarchagumba/ cordyceps Ophiocordyceps sinensis*, and are home to the endangered Snow Leopard, Himalayan Goral, Serow and Himalayan Tahr (Nepal Ministry of Forests and Soil Conservation, 2014).

PRODUCTION

Jatamansi is a perennial, aromatic, herbaceous plant, reaching a height of 10-60 cm (Pradhan and Paudel, 2014). Wild plants are harvested primarily for their roots and rhizomes (Mulliken, 2000). Harvest typically occurs between August-November, after seeds have ripened, but may start as early as July depending on harvesters' needs (Larsen and Olsen, 2008; C. Smith-Hall, University of Copenhagen, *in litt*. to C. Schindler, 1 June 2021). Jatamansi is only found in high mountain areas, so harvesters may travel over multiple days and stay in the mountains overnight during harvest (Subedi *et al.*, 2011). The average number of collection days was 61.6 in 2014-2015 (Timmermann and Smith-Hall, 2019). It is recommended that harvest areas are rotated to ensure Jatamansi is only harvested from each site once every five years, as plants take three years to mature (Ghimire *et al.*, 2008). The general recommendation to ensure regeneration of the plants is to leave one-third of rhizomes intact (CITES, 2019).

Harvesters of Jatamansi live in high mountain areas and have culturally relied on wild-collected medicinal plants for their own use and trade for many generations. In Nepal, these resources are controlled mainly by a community management system. The government has devolved powers of management of forest resources to community forest user groups. This devolution of control and management to local people has reportedly successfully reduced illegal Jatamansi collection and trade (CITES, 2019).

The communities that harvest Jatamansi are often marginalized, with little infrastructure and few employment opportunities (CITES, 2019; Olsen and Larsen, 2003). In these areas, farming opportunities are limited due to the harsh conditions; therefore, collecting medicinal plants provides an important source of income (CITES, 2019; Olsen and Larsen, 2003). A 2007 study in Nepal placed the number of local people involved in the trade of Jatamansi in Nepal alone at around 15 000 (Subedi *et al.*, 2011). Interviews with communities in high Himalayan areas in Nepal estimated that trade in medicinal plants (including Jatamansi) could have accounted for 3-44 percent of household incomes in these communities (Olsen and Larsen, 2003). The trade in medicinal and aromatic plants, including Jatamansi, is therefore a significant source of income for many Himalayan communities (CITES, 2019).

Harvesters typically dig up and dry the Jatamansi before packaging it for sale. Most goods are sold to regional or local traders. However, harvesters are at a disadvantage as there is often a lack of transparency in the trade chain or final value of Jatamansi, which make them vulnerable to being paid less than the market price. In many cases, traders pay the harvesters an advance. This arrangement leads to harvesters being under pressure to harvest enough to pay back the advance, which may lead to unsustainable practices like the harvest of immature plants (Subedi *et al.*, 2011).

Jatamansi collection area, Nepal ©Wolfgang Kathe

TRADE

In the Himalayas, collecting medicinal plants like Jatamansi provides

A CRITICAL SOURCE OF INCOME FOR LOCAL PEOPLE

In 2011, minimal processing of the roots and rhizomes typically occurred at the local level before the product was sold. Harvesters dug up and dried out the Jatamansi before packaging it for sale. The majority of goods were then sold to regional or local level traders in Nepal for the distillation of essential oil (Subedi *et al.*, 2011). Recent years have seen the emergence of the Nepalese medicinal plant secondary processing sector, largely due to the growing demand for medicinal plants in China and India (Caporale *et al.*, 2020). Nepal's legislation prohibits the export of N. jatamansi without processing, with key derivatives/ products in trade being oil and 'marc' (the residue left after the extraction of essential oil) (Government of Nepal, 1993 and 1995, cited in Nepal Department of Forests and Soil Conservation, 2019).

Nepal is currently reported to be the main exporting country of Jatamansi (CITES Trade Database, 2020). Between 2010-2017, exporters reported direct exports of 1 392 364kg of Jatamansi, all from Nepal. Oil made up the majority of reported exports and imports (39 369kg and 1 005kg respectively), while in the reported exports, there was also a significant amount of roots or marc (160 979kg) (CITES Trade Database, 2021). In 2018, the average domestic price of Jatamansi in Nepal was USD 10.80/kg (inflation-adjusted, USD 11.13/kg) across the country (ANSAB, 2018). The price as of June 2021 paid to harvesters was reported to be approximately USD 6/kg (P. Ghimire, Asia Network for Sustainable Agriculture and Bioresources (ANSAB), *in litt*. to C. Schindler, 4 June 2021).

Reported prices offered for Jatamansi internationally vary greatly. Jatamansi exported by range states to non-range states (including Turkmenistan, Ireland, and Canada) varied in price from USD 29-72/kg (Kaur *et al.*, 2020; Dhiman and Bhattacharya, 2020; price figures are as reported by Dhiman and Bhattacharya). Within India's domestic markets, Jatamansi is valued at 350-1000 Indian Rupee (INR)/kg (converted at 30 June 2020 rate to USD 4.55-13.24/kg) for powdered or dried roots (Kaur *et al.*, 2020).

Jatamansi meadow ©Khilendra Gurung/ANSAB

RISKS

Biological:

Assessed as **High** (Schippmann and Leaman, 2021) due to the following factors:

- Its conservation status has been assessed globally as **Critically Endangered** (Ved *et al.,* 2015).
- It is harvested for its roots and rhizomes (Mulliken and Crofton, 2008) and can therefore be **destroyed through collection**.
- Its **distribution** is regionally restricted to the Himalayan mountain range (Ved *et al.*, 2015), at 3300-5000 m above sea level (Baniya, 2010).
- **Local population** sizes are small and scattered thinly across its range (Larsen and Olsen, 2008). Population health throughout its entire distribution range is not known (Chauhan *et al.*, 2021).
- The species is facing **multiple threats** along with a destructive collection practice. Threats include overharvesting and habitat loss, primarily due to agricultural and urban expansion (Mulliken and Crofton, 2008; Ved *et al.,* 2015; Chauhan *et al.*, 2021). Excessive collection and harvesting of the plant without replanting a section of the rhizome has negative effects on the plants (Mulliken and Crofton, 2008).
- It has **several uses,** including as a food additive (Ghimire *et al.*, 2008; Dhiman and Bhattacharya, 2020); medicine (Mulliken and Crofton, 2008); and social use as incense (Ghimire *et al.*, 2008) and perfume (Mulliken, 2000).

Social:

Assessed for **Nepal,** the main exporting producer (Olsen, 2005; CITES Trade Database, 2020), as **Medium** (Schindler, 2021), due to the following factors:

- Jatamansi harvesters can be classified as **vulnerable** as they are typically located in remote, marginalized communities, and rely on medicinal plant harvest for income, sometimes having to take out advance loans from traders (Subedi *et al.*, 2011; CITES, 2019; Olsen and Larsen, 2003).
- Although cases of **forced labour** have not been identified in the Jatamansi trade, loans from an employer (as Subedi *et al.*, 2011, noted can occur with Jatamansi harvesters) can lead to debt bondage, an indicator of forced labour, as harvesters may not be free to leave their employer until they have worked (or harvested) a sufficient amount (ILO, 2012).
- **Health and Safety**: Another potential risk is the distance required to travel to harvesting sites, necessitating multi-day trips in remote and possibly dangerous conditions (Subedi *et al.*, 2011). However, these trips are also anecdotally reported to be important social outings for harvesters, for example for making business deals and arranging marriages (C. Smith-Hall, *in litt.*, 1 June 2021).

biological risk

social risk

Nepal

OPPORTUNITIES

Standards and aertification

Certifications can be a supporting tool to ensure responsible sourcing. A wide range of standards are available that can be applied to wild-harvested plants, such as organic, the Programme for the Endorsement of Forest Certification (PEFC), the Forest Stewardship Council (FSC), Geographical Indication, FairWild, UEBT, FairTrade, and Fair for Life. The FairWild Standard has been demonstrated to be well-suited among relevant sustainability standards to certify CITES Appendix-II listed wild-sourced medicinal and aromatic plant species (Timoshyna *et al.*, 2019). FairWild certified Jatamansi is available, providing an example of a responsible supply chain (FairWild, n.d.).

Partnerships and associations

There are a number of actors involved in medicinal plant governance and harvesting who can be connected with to ensure that any responsible sourcing efforts are meaningful and beneficial to harvesters. These include:

- **Government bodies**: Department of Forests and Soil Conservation, Divisional/ sub-divisional Forest Offices, Department of Plant Resources. If the species is harvested from a conservation area, then the Department of National Parks and Wildlife Conservation and National Parks offices are also involved (P. Ghimire, *in litt*., 4 June 2021).
- **Community bodies**: community forest user groups are involved in the regulation of harvesting and trade (P. Ghimire, *in litt*., 4 June 2021; CITES, 2019).
- **Commercial/trade bodies**: the Nepal Herbs and Herbal Products Association (NEHHPA), Jadibuti Association of Nepal (JABAN), the Herbal Entrepreneurs Association of Nepal (HEAN), and the Ayurvedic Medicine Producers Association of Nepal (AMPAN) (Caporale *et al.*, 2020).

Health and safety

Work with your supplier to look into health and safety during the multi-day trips to harvest Jatamansi, ensuring that these trips are safe, for example with access to fresh water and first aid. Ask workers about any health risks/ issues they experience and what safeguards could be implemented to reduce these.

Conservation

Protecting the regions where Jatamansi grows would have knock-on effects on local species, as well as on the reproduction of Jatamansi itself. Nepal's alpine meadows that are home to high-value medicinal plants including Jatamansi, *Kutki Neopicrorhiza scrophulariiflora*, and *yarchagumba/cordyceps Ophiocordyceps sinensis*, are also home to the endangered Snow Leopard, Himalayan Goral, Serow and Himalayan Tahr (Nepal Ministry of Forests and Soil Conservation, 2014). A range of pollinator species aid Jatamansi's reproduction, including honey bees, ants, and butterflies, and it has been suggested that insect pollination is important for ensuring the maintenance of genetic diversity in populations of Jatamansi (Chauhan *et al.*, 2008). These pollinators require a healthy ecosystem to flourish.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

©Salahaldeen Nadir /World Bank

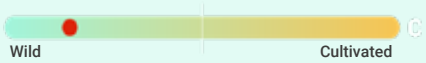
GUM ARABIC, *Senegalia senegal* (L.) Britton

GUM ARABIC, *Senegalia senegal* (L.) Britton

NAMED IN INGREDIENTS AS

Acacia gum, food additive E414[3]

WILD-HARVESTED VS CULTIVATED



Mostly wild, but some is from cultivated trees that are tapped and collected systematically (EFSA ANS Panel, 2017).

DISTRIBUTION

This species grows in the Gum Belt region of Africa, stretching from Eastern and the Horn of Africa to Senegal and Mauritania. The species is also found in Southern Africa: in Namibia, Zimbabwe, Botswana and South Africa, though not yet commercialized in this region. It is also found in Oman, Pakistan, and India (UNCTAD, 2018).

GLOBAL CONSERVATION STATUS

IUCN: Not Assessed

CITES: Not listed

PRODUCTS IT IS FOUND IN

Gum arabic is primarily used in the **food industry** as an additive, as an emulsifier or stabilizer (EFSA ANS Panel, 2017). It is used for similar purposes in the **pharmaceutical industry** (*Ibid.*). Locally, *S. senegal* wood is used for fuelwood, charcoal, in construction, and industrially (for example, an adhesive, a protective colloid and safeguarding agent for inks, and in the manufacture of matches and ceramic pottery) (Sacande and Parfondry, 2018).

OTHER RELEVANT SPECIES

Although this profile focuses on *S. senegal*, the dried sap from another similar tree, *Vachellia seyal*, is also called gum arabic. The sap from both species is internationally traded as gum arabic, although *S. senegal* gum is reportedly more popular in trade (RBG Kew, 2020).
Acacia species have been reclassified into *Senegalia senegal*, *Vachellia seyal*, *Senegalia laeta*, *Senegalia polyaccantha* and *Senegalia mellifera*. All species that were members of the former *Acacia senegal* complex are named Senegalia and those of the *A. seyal* complex as Vachellia (Kyalangalilwa *et al.*, 2013).
There is a range of wild-harvested gums and resins used in food products that are harvested from the same region, known as the Gum Belt, stretching from the Horn of Africa to Senegal and Mauritania (UNCTAD, 2018).

[3]A definition of food additives, as well as a list of those approved for use in the European Union, can be seen here: https://www.legislation.gov.uk/eur/2008/1333/contents

PRODUCTION

Senegalia senegal is a shrub or small tree, adapted to dry conditions and growing mainly across sub-Saharan Africa (RBG Kew, 2020). Its dried sap is harvested as gum arabic. The sap is collected from December to June, and the harvesting season typically lasts about three months during the dry season. The production depends on the tree, ranging between 20 and 2000 grams of gum per tree, with an average of 250 grams (INFOCOMM, 2016). This can be labour-intensive as the trees are scattered across the landscape (Griffon, 2017).

Gum arabic harvesting is carried out by families from the harvesting region or by seasonal workers who come from other areas or states, such as in Chad, where gum collection is mainly an activity carried out by nomadic populations (Griffon, 2017). Gum arabic producers are generally small-scale farmers or low-income ranchers. Many engage in the production of gum arabic to improve household income during the off-season of their main economic activity when cash flow decreases and food insecurity increases. There are also medium and large producers. Families with large land areas can hire labour, lease land, or enter into sharecropping agreements with harvesters. Collecting gum is an important livelihood activity for vulnerable groups, including women, ethnic minorities, seasonal and low-income workers. The division of labour by gender varies considerably between countries and types of gum. In many countries, low pay compared with the amount of work required discourages men and wealthier groups from engaging in gum production (INFOCOMM, 2016).

The harvesters collect the nodules of gum arabic by hand from S. senegal trees. The product is sent to a trader and then to an exporter. The exporter is in charge of the sorting and cleaning (INFOCOMM, 2016).

The use of gum arabic for restoration through cultivation can alleviate climate and political instability in an area where more than 80 percent of the population survives directly on what nature provides. Gum arabic trees can be planted to prevent the loss of water and nutrients from the soil, thus restoring the area in an affordable, practical, and efficient way. Acacia gum is also a vital economic resource for the poor populations of the Sahel and sub-Saharan Africa, allowing pickers to spread their income over a year (Ousseyni, 2020).

GUM ARABIC HARVESTING
creates critical income during labour off-seasons

Senegalia senegal shrub ©Rodrigo Ordonez/GLF

TRADE

Sudan and other countries in the gum belt area supply importing countries mostly with raw or roughly processed gum, which is transformed into products elsewhere and re-exported at a higher value. Since the 2000s, Nigeria, Senegal, and Sudan began producing high-grade gum arabic at local processing facilities; however, their main exports still rely on crude gum. Therefore, the international market is divided into two segments: one related to the raw or semi-processed product produced by Sudan and the other countries of the African belt; and a second that includes the higher value processed product, which is still primarily dominated by developed countries (Sorrenti *et al.*, forthcoming).

Although Sudan, Chad, and Nigeria are the leading producers of raw gum arabic, the majority of **PROCESSING STILL OCCURS OUTSIDE THESE REGIONS**

The three main exporting countries of raw gum arabic are Sudan with 66 percent of global exports, Chad with 13 percent, and Nigeria with 8.5 percent (UNCTAD, 2018). The gum arabic market represents an average value of USD 337 million annually for the period 2014-2016, of which 44 percent was for raw and semi-processed gum and 56 percent for processed gum (COMMODAFRICA, 2018).

58 percent of gum arabic harvested in the gum belt is exported to Europe, 30 percent to Asia, 11 percent to North and Central America, and 0.5 percent to other countries in Africa (Sorrenti *et al.*, forthcoming). France and India are the main importers of gum arabic and represent 75 percent of the import (UNCTAD, 2018).

France conducts a large proportion of gum arabic processing: it produces two-thirds of all processed gum arabic exports. Nexira, a French manufacturer, holds a 50 percent global market share in processed gum arabic products. Because of insufficient investment in local processing facilities, many African countries that export crude gum arabic at low prices end up re-importing processed gum at substantially higher costs to meet local manufacturing demands (UNCTAD, 2018; Sorrenti *et al.*, forthcoming).

In 2018, the total quantity of exported gum arabic was about 168 000 tonnes, 66 percent of which originates from the gum belt where Sudan and Chad play the biggest role (UN Comtrade, 2018). Exports of unprocessed and semi-processed gum arabic have almost tripled in the last 25 years, from an annual average of 35 000 tonnes in 1992–1994 to a yearly average of 102 000 tonnes in 2014–2016. In addition, exports of processed gum arabic more than tripled, from 17 000 tonnes to 53 000 tonnes in the same period (UNCTAD, 2018).

Due to its significance in production and export, Sudan is a price setter for gum arabic. The last ten years have been marked by strong fluctuations linked to the political unrest affecting Sudan. The price on the international market reached USD 3 628 per tonne in 2005 (inflation-adjusted USD 4 808/tonne), falling to USD 1 435 per tonne in 2010 (inflation-adjusted USD 1 703/tonne, ending at USD 1 598 in 2014 (inflation-adjusted USD 1 747/tonne). The hard gum from Sudan was sold for export for USD 2 400/tonne in January 2017 (inflation-adjusted USD 2 534/tonne) (Griffon, 2017).

Once adjusted for inflation, crude gum arabic export revenues have remained fairly stable, from an annual average of USD 95.4 million in 1992–1994 (inflation-adjusted USD 171 million) to a yearly average of USD 150.3 million in 2014–2016 (inflation-adjusted USD 163.5 million). During the same period, revenues from exports of processed gum arabic increased from USD 74.4 million (inflation-adjusted USD 133.4 million) to USD 192 million (inflation-adjusted USD 208.9 million), 90 percent of the value of which went to exporting countries in Europe (UNCTAD, 2018).

Gum arabic is recognized by the Codex Alimentarius[4] as a food additive from *S. senegal* and *Vachellia seyal* (Acacia gum [E]414) (Sorrenti *et al.*, forthcoming; JECFA, 2006). The high quality of Sudanese gum, in particular "Kordofan Hashab", makes it the main reference point, against which other gums are judged (UNCTAD, 2018).

[4] The Codex Alimentarius, or "Food Code", is a collection of standards, guidelines, and codes of practice adopted by the Codex Alimentarius Commission. The Commission is the central part of the Joint FAO/WHO Food Standards Programme and was established by FAO and the World Health Organization (WHO) to protect consumer health and promote fair practices in food trade. For more information, see https://www.fao.org/fao-who-codexalimentarius/home/en/.

RISKS

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- Its **conservation status has not been assessed** globally.
- Its **distribution is regionally restricted** to dry tropics and subtropics zones across Africa and Arabia (Heuzé *et al.*, 2016).
- It has **multiple uses**, including as an emulsifier in multiple food and drink products (Purcell, 2005).
- It is facing **multiple threats**, including climate change (Lyam *et al.*, 2018), livestock grazing, and overharvesting (Omondi, 2016). Although in general, gums and resin-producing species are declining at a significant rate due to habitat degradation or loss, overgrazing, drought, fires, and poor harvesting techniques (Tadesse *et al.*, 2007), Senegalia senegal is less affected by these impacts and shows good regeneration and stable populations, at least in parts of its range (Lemenih and Kassa, 2010; Sarr *et al.*, 2021).

Social:

Assessed for **Sudan, Chad,** and **Nigeria**, the top exporters of gum arabic (UNCTAD, 2018), as **High** (Schindler, 2021), due to the following factors:

- All three of the main exporting countries for gum arabic have complex socioeconomic contexts, including either high instances of **child and/or forced labour**, high vulnerability to forced labour, or both (USDoL, 2019; USDoL, 2020).
- Given that gum arabic harvesting is often a family activity, combined with the socioeconomic context, it is likely that **child labour** occurs in gum arabic supply chains (Griffon, 2017).
- In Sudan, amidst wider internal conflict, trade unions have been dissolved by government committee, thus depriving workers of their **right to freedom of association and collective bargaining** (ITUC, 2020).
- Other concerns include **low pay** to harvesters who are often from marginalized or **vulnerable groups**, putting them at further risks such as recruitment into other illegal activities (INFOCOMM, 2016; Ousseyni, 2020).

MEDIUM

biological risk

HIGH

social risk

Sudan, Chad, and Nigeria

Gum arabic © Sayali Pashte / iStock

OPPORTUNITIES

Conservation and restoration

Protection, sustainable harvesting, and planting of gum arabic trees protects other species and increases their productivity, while supporting the livelihoods of gum arabic harvesters (Ousseyni, 2020). In the Sahel region, acacia trees are being used to rehabilitate dryland vegetation through the Great Green Wall Project, which aims to create a new forest spanning the African continent east to west from Dakar to Djibouti (Diarra, 2020). Gum arabic is the most commercially important gum in the Great Green Wall core area (Sacande and Parfondry, 2018). This creates income-earning opportunities for local people and can contribute to restoring biodiversity (Diarra, 2020).

Partnerships and associations

Engage with local groups, NGOs, and other businesses operating in the region to encourage the planting of further *Senegalia senegal* trees. The Network for Natural Gums and Resins in Africa (NGARA), for example, is a pan-African organization that assists African producer countries in sustainably developing their natural gums and resin resources. If conducted sensitively and in partnership with harvesters, engagement could have a triple benefit of
(1) ensuring a sustainable supply of gum arabic;
(2) supporting more local people to participate in the harvest and earn a living;
(3) contributing to local conservation by limiting desertification and bolstering the *S. senegal* population (INFOCOMM, 2016).

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. A list of those that can be applied to wild-harvested plants can be found in the Conclusion. Specific to gum arabic, there are suppliers interested in achieving FairWild certification if the demand exists.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

Senegalia senegal bark © JMK/Wikimedia Commons

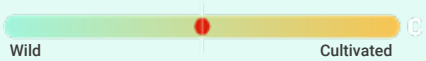
GOLDENSEAL,
Hydrastis canadensis L.

GOLDENSEAL, *Hydrastis canadensis L.*

NAMED IN INGREDIENTS AS

Goldenseal, hydraste du Canada, sceau d'or, eyebalm, ground raspberry, yellow root, orange root, yellow puccoon (L. Oliver, NatureServe, *in litt*. to C. Schindler, 10 June 2021; M. McGuffin, American Herbal Products Association (AHPA), *in litt*. to C. Schindler, 2 June 2021)

WILD-HARVESTED VS CULTIVATED



Both **wild-harvested** and **cultivated** (Oliver and Leaman, 2018). Goldenseal in legal international trade is cultivated.

DISTRIBUTION

Goldenseal is native to large parts of eastern North America. Its native range reaches from south-eastern Canada to 26 states in the eastern United States. The majority of its range occurs in the understories of the U.S. Appalachian and Ozark woodlands (RBG Kew, 2021; Davis and Persons, 2014; NatureServe, 2021).

GLOBAL CONSERVATION STATUS

IUCN: Vulnerable (Oliver, 2017)

CITES: Listed in CITES **Appendix II**. International trade in the following items are regulated: whole, live or dead goldenseal plants and underground parts (i.e. roots, rhizomes): whole, parts and powdered. In the United States of America, international trade in the goldenseal specimens is only in artificially-propagated plants and must be accompanied by a federally-issued permit, while in Canada, export of wild-harvested goldenseal is not permitted (Government of Canada, 2014).

PRODUCTS IT IS FOUND IN

The primary use of goldenseal is for medicinal products which aim to treat infected mucosal membranes, including the mouth, respiratory and gastrointestinal tract (Tims, 2016).

OTHER RELEVANT SPECIES

Other medicinal plants are harvested alongside goldenseal and may therefore benefit from its conservation. For example, the high-value American Ginseng, *Panax quinquefolius* L., overlaps in range with goldenseal and other medicinal plants in the Eastern Deciduous forests of the United States of America. These medicinal plants (including goldenseal) are referred to as "off-roots" and are frequently collected and sold alongside American Ginseng (Kruger *et al.*, 2020)

PRODUCTION

Goldenseal is a medicinal plant that is both wild-harvested and cultivated (Oliver and Leaman, 2018). Goldenseal rhizomes, roots, and leaves are all harvested (Upton, 2001). There are reports of wild goldenseal collection starting in the spring as soon as the plants emerge, but it has been recommended that an autumn harvest would be better, as this gives the plants time to reproduce (Burkhart and Zuiderveen, 2019; Upton, 2001).

A large part of the US domestic trade relies on wild-collected goldenseal roots and rhizomes. There are concerns about overharvest of this species in the wild. Wild collection methods of goldenseal roots and rhizomes tend to select the largest rhizomes. This can affect regeneration, as healthy large reproductive individuals are continually removed from the population (Oliver and Leaman, 2018). The loss of reproductive individuals, coupled with habitat loss, has been linked to declines in wild goldenseal populations (Anon, 2003).

Unlike the US's domestic trade, international trade is limited to artificially propagated plants (Oliver and Leaman, 2018). Cultivation efforts took off in the 1990s, with increasing investment in cultivation from 1997 largely due to the inclusion of goldenseal in CITES Appendix II (Bannerman, 1997; Oliver and Leaman, 2018). According to the CITES Trade Database data (2010-2017), all direct exports of goldenseal roots were from artificially propagated plants (CITES Trade Database, 2020). According to the United States of America CITES Authorities, there are only a handful of growers who produce artificially propagated goldenseal for commercial export, and recent trends indicate that many of these growers have gone out of business amid increasing demand for goldenseal. The combination of high demand and short supply could lead to increased harvest pressure on and overcollection of the wild plant (Chamberlain *et al.*, 2018).
The collection of NWFPs in the Eastern United States of America is an important traditional cultural and recreational activity, as well as a supplementary form of income (Kruger *et al.*, 2020). However, there is limited information available on goldenseal harvesters and cultivators.

Wild collection of goldenseal is not a subsistence activity in the US. Rather, it is driven both by opportunity and the need for money, which is influenced by the job market and market demand (Chamberlain *et al.*, 2018). The loss of jobs in the local economy and increased market demand influence and trigger increased harvest. The market value of raw botanicals influences cultivation efforts (*Ibid*.). Generally speaking, the production costs often exceed the market price. While market values fluctuate, the value of goldenseal has at times reached amounts sufficient to justify cultivation (*Ibid*.).

The collection of wild plants like goldenseal in the eastern USA is an **IMPORTANT CULTURAL ACTIVITY**

Goldenseal rhizome ©Priya Jaishanker

TRADE

There is both a domestic and international market for goldenseal medicinal products. Currently, the majority of the domestic trade in the United States of America and international trade of goldenseal depends on fresh or dry rhizomes and roots, either in a whole or powdered form (Oliver and Leaman, 2018; Tims, 2016).

The US botanicals market is largely driven by middlemen who consolidate the material for export. These consolidators control the downstream prices paid to growers or diggers, and realize the upstream profits (Bailey, 1999; Chamberlain *et al.*, 2018; Kruger *et al.*, 2020). Notably, few of the United States of America exporters of propagated plants are the actual growers (P. De Angelis, US Fish and Wildlife Service (USFWS), *in litt*. to C. Schindler, 29 July 2021).

International trade of goldenseal is reported as shown in Figure 2 below (CITES Trade Database, 2020). All direct exports of this plant recorded in the CITES Trade Database between 2010 and 2017 reported the plants to be from artificially propagated stocks. Approximately 37.5 percent of all exports are reported to originate from the United States of America and 62.5 percent from Canada. The countries that reported importing the most goldenseal roots by mass between 2010 and 2017 were the United States (10 787kg), Australia (8 261kg) and Germany (4 299kg) (*Ibid*.).

USA, AUSTRIA, GERMANY
were the top importers of goldenseal roots between 2010-2017

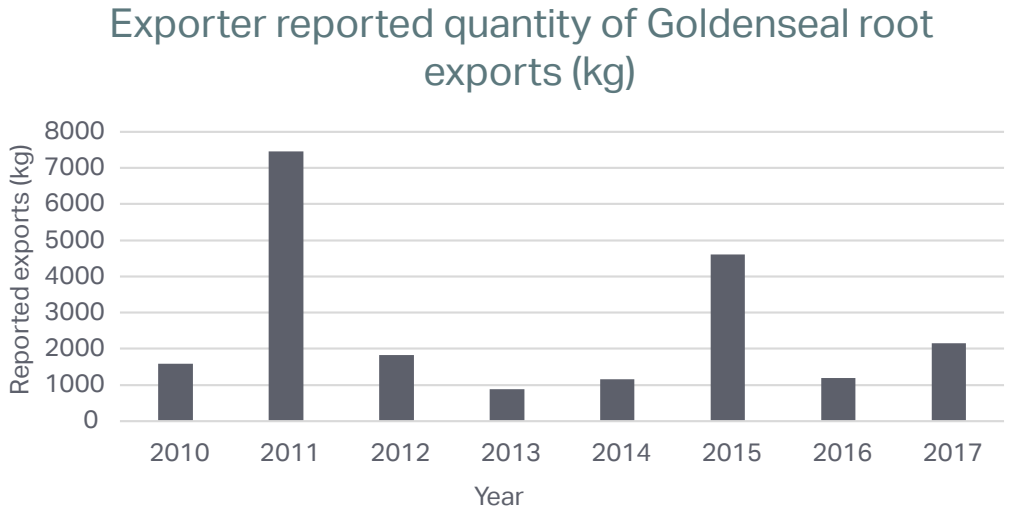


FIGURE 2
Reported international exports of artificially propagated goldenseal from 2010-2017
Source: CITES Trade Database, 2020.

The price of goldenseal roots and rhizomes was reported to fluctuate significantly from year to year. Between 1996 and 2005, the price per kilo of goldenseal root paid to the harvester was reported to vary between USD 44-77/kg (inflation-adjusted USD 65-114/kg) for wild harvesters but up to USD 110/kg (inflation-adjusted USD 163/kg) for organically cultivated plants (Tims, 2016). Dried goldenseal leaf prices varied from USD 2.2-11.0/kg between 2004-2010 (inflation-adjusted USD 2.77-13.83/kg) (*Ibid*.).

RISKS

Biological:

Assessed as **High** (Schippmann and Leaman, 2021) due to the following factors:

- The species is globally assessed by IUCN as **Vulnerable** (Oliver, 2017).
- The plant is harvested for its roots (Oliver, 2017) and can therefore be **destroyed through collection**.
- The plant is **slow-growing**: seed production is low (USDA, 2003), natural germination of seeds is slow (Sharp, 2003), and it can take two years for goldenseal to grow from seed to producing its first true leaf (Sinclair *et al.*, 2005)
- The species is facing **multiple threats**. The most important threats to wild populations of goldenseal are habitat loss and degradation (Oliver, 2017; NatureServe, 2021). Unsustainable wild harvesting for use in the medicinal industry is also a threat, compounded by the slow growth and regeneration of the species (USDA, 2003; NatureServe, 2021). Deer browsing and pressure from invasive species are further threats (Oliver and Leaman, 2018; COSEWIC, 2019; NatureServe, 2021).

Social:

Assessed as **Low** (Schindler, 2021) for the United States of America and Canada. However, it is important to note that little social data are available on goldenseal harvesters, so this risk rating should be taken with caution and due diligence should nevertheless be undertaken. The risk rating was determined due to the following:

- The United States of America and Canada experience relatively low rates of modern slavery and corruption at the country level compared to other nations (Walk Free Foundation, 2018; Transparency International, 2021).
- At the species level, the collection of NWFPs, including goldenseal in the Eastern United States of America, tends to be a supplementary form of income rather than the main earning activity for households (Kruger *et al.*, 2020; Trozzo *et al.*, 2019), meaning less reliance on a single species, which could be precarious.
- There are **potential use conflicts** with Indigenous people: in Canada, goldenseal is a culturally important species to the Indigenous Algonquin People, while Indigenous uses of the plant have also been documented in the United States of America (McDermott and Wilson, 2010; Tims, 2016).

HIGH

biological risk

LOW

social risk

United States of America and Canada

Goldenseal berries ©Wikimedia Commons

OPPORTUNITIES

It is essential to understand whether the goldenseal you are purchasing is wild-harvested or cultivated. As a domestic buyer, cultivated plants should be preferred, considering the high conservation risk level for wild-harvested goldenseal. As an international buyer, you must be purchasing artificially propagated goldenseal with the proper CITES permits.

If you are a domestic buyer, and wild-harvested must be purchased, pursue the following opportunities to make the purchase more responsible:

Conservation and restoration

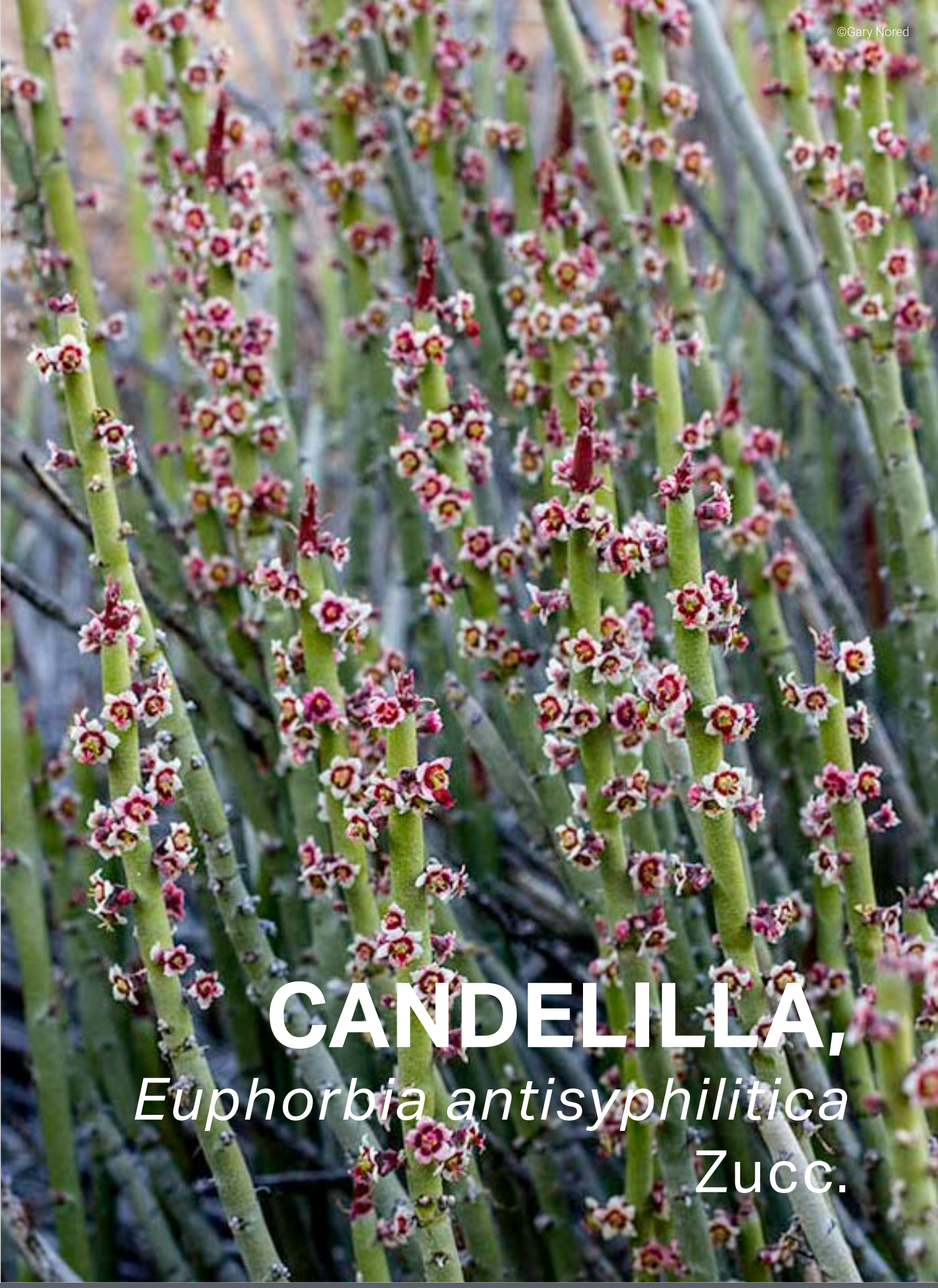
Engage in dialogue with the company and/or harvester supplying wild goldenseal. Is the harvest being conducted sustainably – for example is there a harvest plan available that allows for sufficient species survival/regeneration?

Partnerships and associations

Engage with local groups and NGOs, such as United Plant Savers and the American Herbal Products Association, to ensure that responsible and/or monitored sourcing of wild goldenseal occurs on a broader scale, as well as to support cultivation trials.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

Goldenseal, forest farming ©Forest Farming



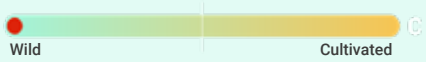
CANDELILLA,
Euphorbia antisyphilitica Zucc.

CANDELILLA, *Euphorbia antisyphilitica* Zucc.

NAMED IN INGREDIENTS AS

Candelilla wax, food additive E902[5]

WILD-HARVESTED VS CULTIVATED



Wild.

DISTRIBUTION

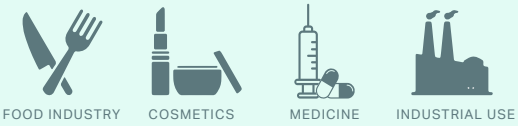
Mexico, the United States of America (New Mexico, Texas) (RBG Kew, 2021b) Within Mexico, candelilla is extracted from the Chihuahuan desert, and 80 percent of the country's total output is extracted from the state of Coahuila (Candelilla Institute, 2013; Govea, 2018).

GLOBAL CONSERVATION STATUS

IUCN: Not assessed

CITES: Listed in CITES **Appendix II** since 1975 under the generic listing of Euphorbia spp. The final products of E. antisyphilitica (packaged and ready for retail trade) containing Candelilla wax have been excluded from CITES regulations (Annotation 4#, f).

PRODUCTS IT IS FOUND IN



Candelilla wax has a variety of uses in cosmetics, food, pharmaceuticals, and industrial uses (for example waxes and polishes). It was a common ingredient in chewing gum and, more recently, has risen in popularity in cosmetics as a natural and vegan alternative to beeswax and other waxes (Candelilla Institute, 2013; Transparency Market Research, 2021).

OTHER RELEVANT SPECIES

Some of the other plants harvested from the Chihuahuan desert include *Agave lechuguilla* Torr. for its fibres (Ixtle); oregano condiment from *Lippia graveolens*; and coal, wood, and food from *Prosopis laevigata* (Candelilla Institute, 2013).

Carnauba *Copernicia prunifera* wax is a wild ingredient used similarly in cosmetics, food, and industrial uses that is harvested from a species of palm growing only in Brazil's poorest, north-eastern states (Knight, 2017). Modern slavery has been identified in its supply chains (*Ibid.*).

[5] A definition of food additives, as well as a list of those approved for use in the European Union, can be seen here: https://www.legislation.gov.uk/eur/2008/1333/contents

PRODUCTION

Candelilla wax is derived from the stems of the Candelilla shrub, which grows only in the Chihuahuan desert in Mexico and parts of the United States of America. Candelilla harvest and processing is carried out using traditional techniques. The harvesters pull out the entire plant by hand from the roots or by using a sharpened stick to facilitate digging (Candelilla Institute, 2013). Harvesting periods occur every 3-5 years by area, depending on rainfall, to allow the plant to regenerate (Martínez-Ballesté *et al.*, 2013; Garza and Berlanga, 1993). According to harvesters, the best practice is to rip the plant from the ground by hand, leaving rhizomes underground to regenerate (P. Mosig Reidl, CONABIO, *in litt*. to C. Schindler, 25 May 2021). The candelilla plants produce more wax between September-January and have a reduced wax production from May-August when the plants produce flowers and summer humidity is high (Martínez-Ballesté *et al.*, 2013). The wax quantity produced also depends on the way the plant is cut and dried pre-extraction. The percentage of wax produced from the total estimated plant biomass is 1 percent to 4 percent but can go up to 7 percent in ideal conditions (Garza and Berlanga, 1993).

After cleaning, bundles (or "tercios") of 20-30 kg are prepared for transportation by mules, donkeys, or vehicles (Candelilla Institute, 2013; P. Mosig Reidl, *in litt*., 25 May 2021). The plants are then brought to collection centres, 25 to 150 km away (*Ibid*.). Collection and processing are often conducted within the same groups or communities (P. Mosig Reidl, *in litt*., 25 May 2021). Plants are usually air-dried for two to three weeks before wax extraction (Garza and Berlanga, 1993).

The wax extraction is done by mixing water and sulfuric acid in iron cauldrons (Candelilla Institute, 2013). The separation of the wax happens after the mixture comes to a boil. Despite its toxicity, the acid is needed to prevent an emulsion between wax and water in the process. The wax is collected in steel tanks or clay cones in the floor. By decanting, different layers are formed, and the wax is left to solidify after removing the impurities. To reach the quality necessary to be commercialized, the wax must be broken up into pieces to be melted and filtered through clay, carbon, or other filtration systems (*Ibid*.).

The refining process can also include a bleaching stage, which uses hydrogen peroxide (Candelilla Institute, 2013).

The local people involved in this industry are known as candelilleros and are from the lowest socioeconomic brackets with a minimal income (Martínez-Ballesté *et al.*, 2013). Studies of selected groups of candelilleros suggest that Candelilla harvesting and trade income may constitute up to 70 percent of their monthly income (Arato *et al.*, 2014).

Candelilla plants are collected on ejidos – 'extensions of common land provided to a group of tenants' – according to use permits issued by the Mexican authorities, which regulate the use and preservation of the resource (Arato, 2017). More than 20 000 farmers in Mexico earn a living from this activity (Andrew, 2017). One source reports that in 2013, they were organized around 230 ejidos (communally owned land areas) across 33 municipalities in Mexico (Candelilla Institute, 2013). The collection is generally undertaken by men (Arato *et al.*, 2017).

Collection areas for Candelilla are remote and difficult to access, meaning the harvesters must set up temporary camps and travel long distances before bringing the wax back to the ejidos for processing (Turner, 2009). Typical harvesting trips can last five days or longer, 25km-150km away from home, and harvesters can occasionally face access rights issues when candelilla is located on private land (Candelilla Institute, 2013).

A visit by a documentary crew to a Candelilla processing facility in 2020 revealed workers handling sulfuric acid, a dangerous chemical that can have immediate and long-term health effects, with no safety equipment and improper storage. The documentary also describes low wages given to workers despite their dangerous and challenging work (Richardson, 2020). Verisk Maplecroft, specialists in data and risk analysis, have classified Candelilla wax as a cosmetics ingredient with a high environmental, social, and governance (ESG) risk (Norris, 2018).

20 000
the number of farmers in Mexico who earn from candelilla harversting

Candelilla Wax © Maša Sinreih/Wikimedia Commons

TRADE

USA, JAPAN, GERMANY, FRANCE
top importers of candelilla wax

The majority of Candelilla wax that is produced is exported. Within Mexico, candelilla is extracted from the Chihuahuan desert, and 80 percent of the country's total output is extracted from the state of Coahuila (Candelilla Institute, 2013; Govea, 2018).

Candelilla is the most traded wild-sourced medicinal and aromatic plant species product listed on CITES Appendix II by volume (Furnell and Timoshyna, 2018). According to the CITES Trade Database, the only exporting country for Candelilla is Mexico; Figure 3 shows total exports from Mexico between 2009 and 2018 (UNEP-WCMC, n.d.). The major importing countries during this period were the United States of America (total ca. 5 000 mt) and Japan (ca. 4 000 mt), followed by Germany and France (UNEP-WCMC, n.d.).

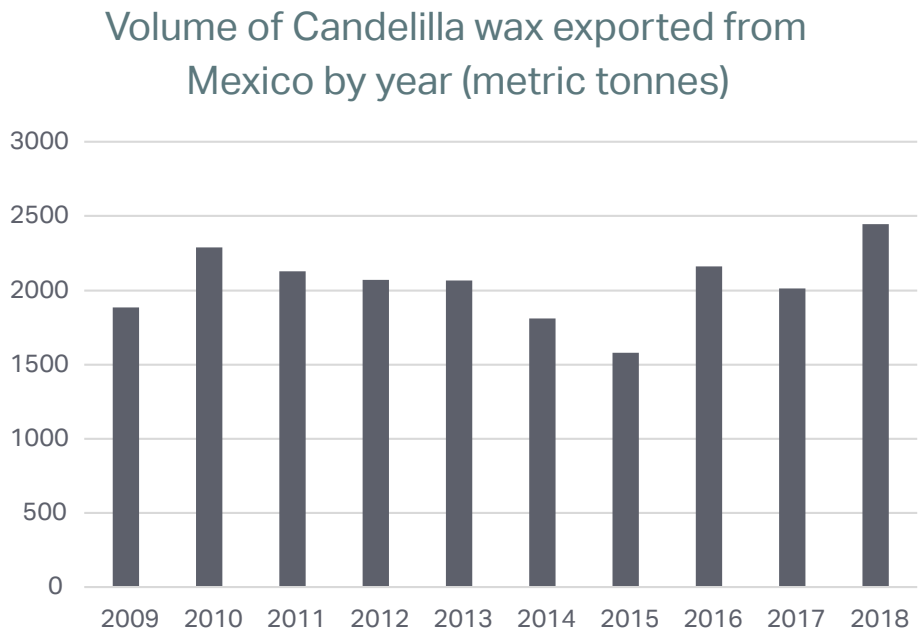


FIGURE 3
Source: UNEP-WCMC, n.d.

A typical Candelilla supply chain starts from candelilleros harvesting Candelilla and processing it to obtain cerote (wax in its simplest form). It is commonly purchased by harvesters working for refineries on a commission basis or informal buyers ('coyotes'). From there, it is sold on to refiners or distributors (typically within Mexico), who then sell on to the international market (Arato *et al.*, 2014). There are a small number of major refiners and traders in Candelilla wax in Mexico: Ceras Naturales Mexicanas, S.A. de C.V. (Cenamex), Pronamex (Producción Natural Mexicana S.A de C.V) and Multiceras SA, among others (CITES, 2009).
In recent years, it is reported that it is more common for trading companies in Mexico to make pre-arrangements with the candelilleros, buying the wax at a fixed price before it is harvested. Those same companies use consultants that identify the potential areas to harvest and elaborate the harvest proposal. The harvest proposal is assessed by the State and federal authorities and must be approved before the harvest occurs (P. Mosig Reidl, *in litt*., 25 May 2021).

By 2005, after refining, the price of candelilla wax in Mexico ranged from USD 3.3 to 3.5 (inflation-adjusted USD 4.37-4.64/kg) and from USD 47.8 per kilogram in Italy (inflation-adjusted USD 63.34/kg) (Rojas *et al.*, 2011). Table 5 shows price fluctuations from 2017-2021.

MONTH/ YEAR	MEXICAN PESOS/KG	USD/KG	INFLATION-ADJUSTED (USD/KG)	SOURCE
May 2017	80	4.29	4.53	https://eltiempomonclova.mx/noticia/2017/pese-a-ser-un-trabajo-muy-pesado-y-riesgoso.html
August 2019	50	2.49	2.52	https://www.milenio.com/estados/candelilla-sustento-de-familias-en-el-valle-de-acatita
Early 2020	75-85	3.97 to 4.50	3.97-4.50	https://eltiempomonclova.mx/noticia/2020/coyotaje-afecta-a-mil-candelilleros.html
May 2020	40	1.80	1.80	https://www.milenio.com/estados/coronavirus-coahuila-candelilleros-sobreviven-pese-pandemia
June 2020	50	2.17	2.17	https://vanguardia.com.mx/articulo/la-candelilla-ya-no-les-da-migran-familias-de-ejido
July 2020	20-30	0.90 to 1.35	0.90-1.35	https://eltiempomonclova.mx/noticia/2020/coyotaje-afecta-a-mil-candelilleros.html
February 2021	60-70	2.88 to 3.35	2.79-3.26	https://eldiariodecoahuila.com.mx/2021/01/12/aumenta-precio-de-candelilla-a-beneficio-de-campesinos/
April 2021	80	3.97	3.86	https://www.laprensademonclova.com/2021/04/11/aumenta-precio-de-cera-de-candelilla/

TABLE 5
Price fluctuation in the Mexican market for candelilla from May 2017 to April 2021.

RISKS

MEDIUM

biological risk

HIGH

social risk

Mexico

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- The species' **conservation status has not been assessed** at a global or national level.
- The typical **harvesting method can be destructive**: tearing the plants from the ground, including roots (Turner, 2009).
- The species' range is **regionally restricted** to the Chihuahuan Desert region in Mexico and the United States of America (Schneider, 2009).
- The species faces **one significant threat**, which is over-harvesting (Barsch, 2004; Anon, 2009). Despite this, the species is still considered common in many parts of its range (Barsch, 2004; O'Connor and Thompson, 2014; Martínez-Ballesté *et al.*, 2013).

Social:

Assessed for **Mexico**, the only country exporting Candelilla (UNEP-WCMC, n.d.), as **High** (Schindler, 2021), due to the following factors:

- Although cases specific to candelilla have not been identified, there is a high risk of **child labour,** with cases identified across many Mexican agricultural products, from coffee to peppers to tomatoes (USDoL, 2019). Carnauba wax, a similar wild ingredient harvested in Brazil, has had documented cases of modern slavery identified in its supply chains (Knight, 2017).
- **Health and safety** is a critical concern, as sulfuric acid is vital in processing candelilla. Multiple processing sites have been observed without access to safety equipment or proper chemical storage facilities (Turner, 2009; Norris, 2018).
- Candelilleros do not typically have health insurance; however, it is anecdotally reported that some trading companies have started to offer healthcare to the ejidos in exchange for the exclusivity of production (P. Mosig Reidl, *in litt*., 25 May 2021).
- **Low wages** are typical, and as Candelilleros are located in remote desert regions with few employment opportunities, they may be **vulnerable** to exploitation (Martínez-Ballesté *et al.*, 2013).

CandelillaPlant ©Wikimedia Commons

Candelilla flowers ©Carlos Velazco

OPPORTUNITIES

Candelilla is considered a vegan alternative to beeswax and provides income in desert regions of Mexico where employment opportunities are sparse; therefore, establishing an ongoing sustainable trade is essential for supporting local livelihoods.

Opportunities include:

Health and safety

Sulfuric acid is a key component in the processing of candelilla wax and poses a significant health and safety risk. Work directly with suppliers wherever possible to ensure that adequate safety equipment is provided to, and being used by, workers.

Partnerships and associations

Engage with government bodies, local organizations, and NGOs such as the Candelilla Institute and CONABIO to support capacity building around sustainable harvest techniques and safer, more efficient innovations in processing.

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. A list of those that can be applied to wild-harvested plants can be found in the Conclusion. Specific to candelilla, the FairWild Standard has been demonstrated to be well suited among relevant sustainability standards to certify CITES Appendix-II listed wild-sourced medicinal and aromatic plant species (Timoshyna *et al.*, 2019).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

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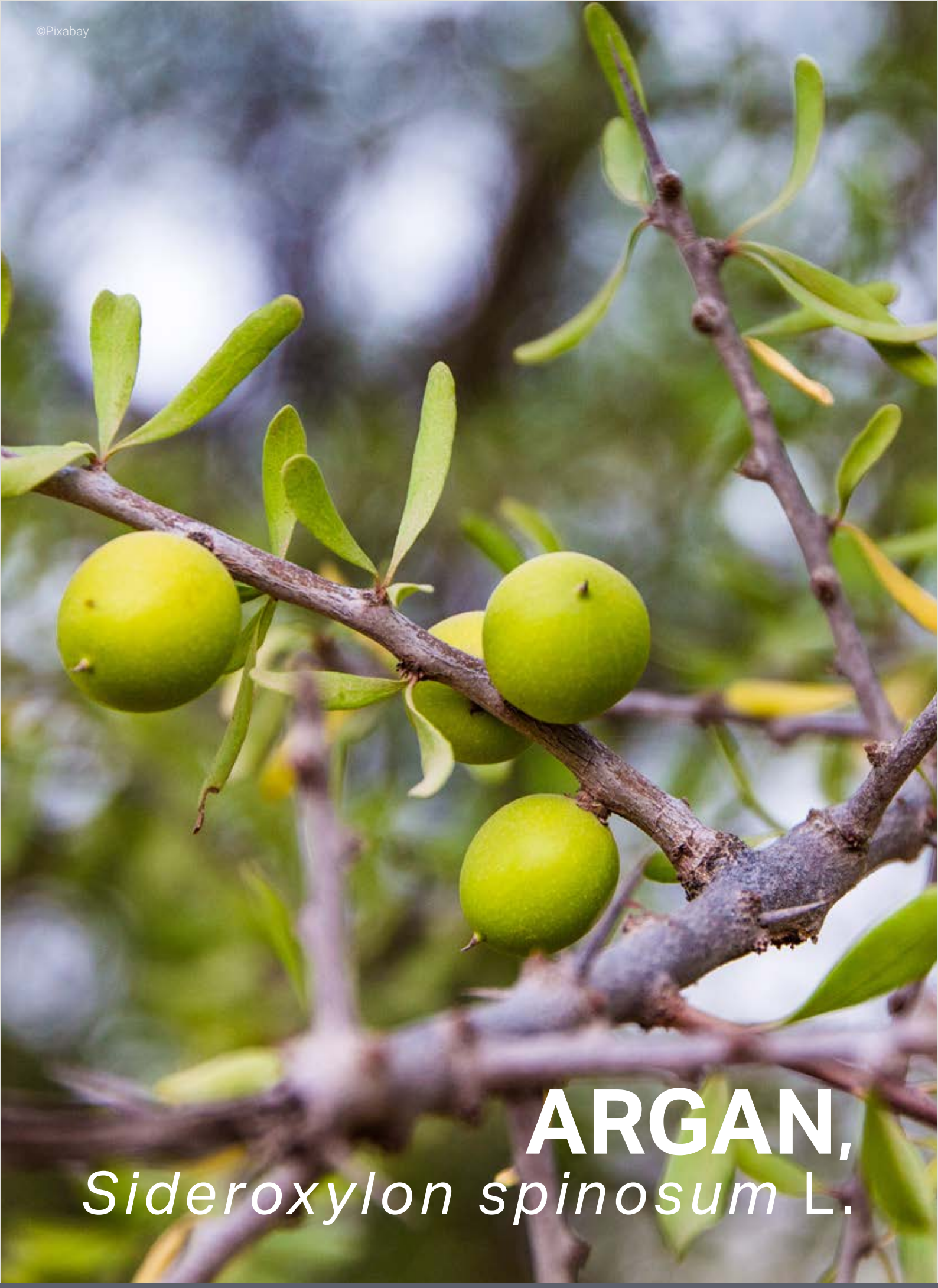


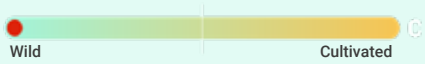
ARGAN,
Sideroxylon spinosum L.

ARGAN, *Sideroxylon spinosum* L.

NAMED IN INGREDIENTS AS

Argan oil, Moroccan oil

WILD-HARVESTED VS CULTIVATED



Wild (UNESCO, 2021)

DISTRIBUTION

Algeria, Mauritania, Morocco, Western Sahara territory (RBG Kew, 2021a; Fennane and Ibn Tattou, 2005). Morocco is the only country exporting argan oil (Grand View Research, 2020; Charrouf and Guillaume, 2007a; Glaser, 2010).

GLOBAL CONSERVATION STATUS

IUCN: Vulnerable (Oldfield, 2021).

CITES: Not listed

PRODUCTS IT IS FOUND IN

Internationally, argan oil is primarily found in cosmetics, prized for its anti-ageing properties (Moulds, 2015). Medicinally, it is used to treat various skin and joint ailments from acne to arthritis (*Ibid*.; Pagliuca *et al.*, 2018). Domestically, argan oil is consumed as food, while argan leaves are used medically for reducing fevers and inflammation, the wood for its gastroprotective properties, and the fruit press cake as a shampoo and for its anti-scabies properties (Msanda *et al.*, 2021).

OTHER RELEVANT SPECIES

Aromatic and medicinal plants from the argan ecosystem are a vital source of income in the region. Wild harvesting represents upwards of 90 percent of Morocco's national production activities. The most harvested plants of Morocco that are under threat are *Thymus satureioides, Thymus leptobotrys, Artemisia herba-alba, Mentha. suaveolens* subsp. *timija, Lavendula dentata,* and *Lavendula mairei* Humbert (Msanda *et al.*, 2021).

PRODUCTION

The argan tree is a species of the arid Moroccan Southwest, where argan forests cover more than 870 000 hectares (Philippe and Mhirit, 1999) and play a significant role in the lives of rural societies (Meagher, 2020). The legal status of the argan trees is described in the Dahir (King's Decree) of 4 March 1925, and the specifications for agricultural practices under argan trees of 20 July 1983. The argan forests of Morocco are state-owned with extensive rights of use. The local populations have the right to harvest fruits and collect wood for personal use and the right to free passage. The right to cultivate requires an authorization by the local Water and Forest Government Agency, and a fee must be paid. Furthermore, each village has the legal obligation to keep its trees in good condition (Stussi *et al.*, 2005).

Several steps are required to obtain the oil, starting with harvesting the fruit by hand. Next, the seeds are removed and separated from their shells and then dried and roasted. Next, the seeds are ground up and milled into a paste – this involves prolonged hand-mixing and crushing into an argan kernel 'dough' from which the oil is extracted, with an extraction yield of up to 35 percent (Laaribya *et al.*, 2017). Using the traditional methods, it would typically take one woman 16 hours and about 30 kg of argan fruit to produce 1 litre of oil (Zhong, n.d.). The processing method can be improved with electric screw-presses, which save on manual work and improve the extraction yield up to 60 percent without decreasing its quality (Guillaume and Charrouf, 2011).

Harvesters are typically organized in cooperatives (Ark *et al.*, 2012). Most of the harvesters in the labour-intensive artisanal oil industry are women who are part of the Indigenous nomadic minority - the Berbers, more specifically Amazigh, meaning 'argan forest native' (Meagher, 2020; Guillaume and Charrouf, 2011). Amazighes are Indigenous People who have lived in and used the Argan forests of arid southwest Morocco for centuries.

There have been imbalances noted between local Moroccan cooperatives and foreign companies, the latter of which control up to 60 percent of the Argan oil exports.
The Moroccan government supports some women's cooperatives by providing equipment, including oil extraction machines, and occasional training courses that focus on marketing and advertising (El Ouadi, 2018).

In socio-economic terms, the argan trees are vital and economically support around 3 million people, with 2.2 million of those in rural areas (Laaribya *et al.*, 2017). Those involved in the argan harvest, processing, or trade in Morocco on average earn between 25-45 percent of their families' total income from argan (*Ibid.*). Argan woodlands also provide various other economic opportunities like eco-tourism and sales of local products, which can contribute to the socio-economic development of rural communities (*Ibid.*). However, the number of people working in argan overall is decreasing due to changes in rural lifestyles: local populations are moving from the countryside to work in cities (*Ibid.*).

Low pay has been identified as an issue in argan harvesting and processing, as well as long hours – sometimes 10-12 hours per day due to pressure to meet buyers' demands (Meagher, 2020). Although critical in argan harvesting and processing, Amazigh women are often illiterate and have been marginalized in decision-making (Moulds, 2015). Women's average incomes from argan oil in 2015 remained below minimum wage, while recent increases in argan oil prices tended to be enjoyed by companies higher up the supply chain (*Ibid.*). The increasing mechanization of argan oil production has certain benefits, such as reducing the manual work of women, but also disadvantages, namely keeping labour costs low (*Ibid.*; Guillaume and Charrouf, 2011).

THE LIVELIHOODS OF MILLIONS OF INDIGENOUS MOROCCAN WOMEN
and their families are linked to argan harvest and production

10 MAY
declared the UN International Day of Argania

Argan oil production ©FAO

TRADE

argan oil exports are estimated to be worth **USD 30 MILLION** annually for Morocco

Typically, the cooperatives produce and transport the argan oil to refineries for further processing. Due to the growth of exports to Europe and North America, the industry has organized itself as a network of manufacturers, traders, and distributors. To avoid intermediaries, manufacturers are often in charge of buying directly from the local cooperatives and exporting. Online retail stores are commonly used to maximize argan oil sales and increase their penetration into the consumer market (Grand View Research, 2020).

Primary consumers of argan oil are Europe and the U.S., with a strong demand for the personal care and cosmetics industry. The oil processing to cosmetic grade is mainly done in Europe using solvent extraction of kernels and is mainly used to prepare moisturizers, shampoos, and other cosmetic products (Grand View Research, 2020).

Official statistics about argan oil production are difficult to obtain because there is no specific HS Code that it is traded under. In 2018, it was reported that Morocco produces more than 4 400 tonnes annually, while a report from 2016 estimated that 700 tonnes were exported per year (El Ouadi, 2018; Calcuttawala, 2018). In 2018, it was estimated that exports of argan oil generated USD 30 million annually for the country (El Ouadi, 2018).

The argan oil market was valued at USD 224million in 2019, and this number is expected to have grown since. Growth is due to increasing product demand from several end-use industries such as food, cosmetics, and medicines, and the favourable regulatory policies in countries like the U.K. and the United States of America (Grand View Research, 2020).

The price of argan oil has almost quadrupled in recent years and is now at USD 30/L (300 dirhams/L) on the local markets and more than USD 300/L (3000 dirhams/L) in the export market (Msanda *et al.*, 2021; currencies as reported by the author). In 2021, argan oil is considered the most expensive edible oil in the world (UNESCO, 2021). In domestic markets in Morocco, the cost of argan oil is seven times lower, around USD 40/L (El Ouadi, 2018; currency as reported by El Ouadi).

RISKS

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- The species is assessed as **Vulnerable** (Oldfield, 2021).
- It is **slow-growing** (Diaz-Barradas *et al.*, 2010) and long-living (typically 200-250 years with some believed to be over 400 years old) (Wickens, 1995), and therefore has a **long regeneration time**.
- Argan has **multiple uses**, including internationally in food, pharmaceutical, and cosmetics industries (Goik *et al.*, 2019), and domestically as food for livestock (Wickens, 1995), environmentally to create shade and prevent soil erosion (Wickens, 1995; Moussouris and Regato, 2002), as food in oil format (Wickens, 1995; Moussouris and Regato, 2002), and as medicine (Msanda *et al.*, 2021; McCutchan, 2016).
- It is facing **multiple threats**, including:
  - a reduction in habitat area and quality since the early 1900s by intensive cultivation and grazing (Belyazid, n.d.; Msanda *et al.*, 2021; Stussi *et al.*, 2005)
  - overharvest of wood, including historic production of charcoal (Ruas *et al.*, 2015) which was made illegal from 2000 (B. Haddane, University of Rabat Institut Scientifique, *in litt*. to C. Schindler, 16 June 2021), and of fruit for oil production (Orwa *et al.*, 2009; Chakhchar *et al.*, 2017)
  - increasing use of water sources for cultivation, along with increasing temperatures and drought as a result of climate change (Zuzunegui *et al.*, 2017; Msanda *et al.*, 2021; Stussi *et al.*, 2005).

Social:

Assessed for **Morocco** as **High** (Schindler, 2021), due to the following factors:

- There are reports of **child labour** specifically in argan harvesting and planting (U.S. DoL, 2019). 'Laws related to the minimum age for work and the use of children for illicit activities [in Morocco] do not meet international standards, and labour inspectors are not authorized to assess penalties' (U.S. DoL, 2019, p.850).
- Women from indigenous Amazigh communities typically engage in harvesting, groups which are more **vulnerable** to potential discrimination and/or harsh treatment because of their marginalized status – there have been documented cases of poor working conditions and intermittent pay even within female cooperatives (Ark *et al.*, 2012; Genin and Simenel, 2011; Moulds, 2015; Perry *et al.*, 2019).

biological risk

social risk

Morocco

OPPORTUNITIES

Argan presents an opportunity to support female and indigenous livelihoods within vulnerable regions and, in turn, support conservation efforts of the argan tree and its wider ecosystem.
Specific opportunities include:

Conservation and restoration

Through taking action to protect, and responsibly harvest from, argan trees, there is the opportunity to protect a much wider network of unique species dependent on them. S. spinosum ecosystem contains one third of the Moroccan flora – over 1000 species and sub-species of vascular plants, 140 of which are endemic to Morocco (Benabid and Fennane, 1999). Several species have agronomic, medicinal, aromatic, and melliferous value (Taleb, 2014). The argan forests are of such importance, both historically and ecologically, that the Food and Agriculture Organization of the United Nations (FAO) recognized the Argan-based agro-sylvo-pastoral system within the area of Ait Souab - Ait Mansour in Morocco as a Globally Important Agricultural Heritage System in 2018, and in 2021, declared the 10th May as the UN International Day of Argania (FAO, 2021).

Access and benefit sharing

The argan tree fruit is currently heavily exploited by a hundred or so women's cooperatives and foreign companies based in Morocco. Still, the argan ecosystem receives few benefits arising from the use of its products (B. Haddane, *in litt*., 1 June 2021). The valuation and sustainable management of argan products are dependent on the development and implementation of a Moroccan national strategy on Access and Benefit Sharing (ABS) arising from the utilisation of plant genetic resources. The introduction of the ABS process would contribute effectively to the improvement of local populations' living standards and act as a tool for sustainable use and management of the resource, and therefore sustainable development at the local and regional level (Taleb, 2014).

Partnerships and associations

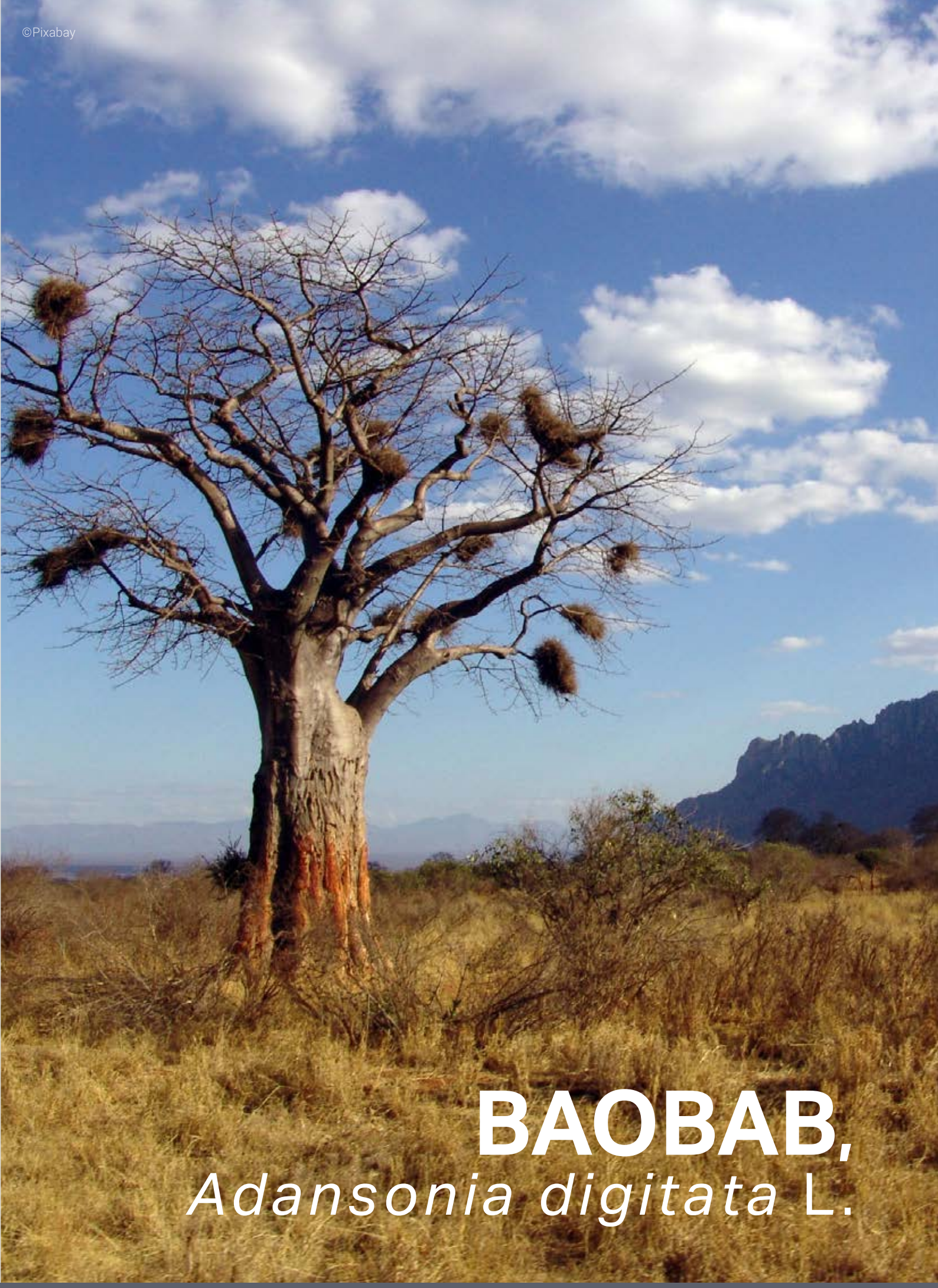
The following initiatives are already taking place and can be partnered with to further impact:

- The Project for Market Access of Products of Terroir (PAMPAT), launched in 2013, supported by the Swiss Secretariat for Economic Affairs (SECO)and implemented jointly by United Nations (UN) agencies and the Moroccan government, aims to improve quality, market access, and socio-economic conditions of workers within two major Moroccan export products – argan oil and prickly pear (PAMPAT, n.d.).
- The German Agency for International Cooperation (GIZ) has also played a role in supporting the establishment of women's cooperatives in argan oil (El Ouadi, 2018).
- Despite the social risks identified, there are examples of well-executed female cooperatives that have been successful in protecting Argan trees and uplifting local communities (Laaribya *et al.*, 2017; Moulds, 2015). These types of initiatives ensuring fair pay are essential for stemming the rural-urban migration flow and ensuring that valuable traditional knowledge is not lost, as well as ensuring a sustainable supply of argan oil (Laaribya *et al.*, 2017).
- The Union of Women's Cooperatives of the Arganeraia (UCFA) is one of the major producer cooperatives in the region and ensures a sustainable and fair use of the resource while offering fair working conditions to the women (Ark *et al.*, 2012).

Standards and certification

A wide range of standards are available that can be applied to wild-harvested plants, such as organic, PEFC, FSC, Geographical Indication, FairWild, UEBT, FairTrade, and Fair for Life. Standards can provide an important reference point on how to address the complex social and biological risks associated with argan.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.



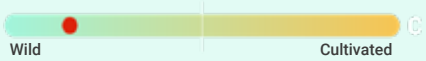
BAOBAB,
Adansonia digitata L.

BAOBAB, *Adansonia digitata* L

NAMED IN INGREDIENTS AS

Baobab

WILD-HARVESTED VS CULTIVATED



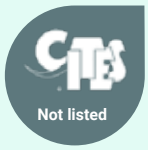
Mainly wild, although domestication has begun in many African countries (Munthali *et al.*, 2012; Venter, 2012).

DISTRIBUTION

Indigenous in semi-arid sub-Saharan Africa between the latitudes of 16˚N and 26˚S, extending from Angola through Southern Africa to East Africa, as far north as Sudan and Ethiopia (e-Flora of South Africa, 2018).

GLOBAL CONSERVATION STATUS

IUCN: Not assessed



CITES: Not listed

PRODUCTS IT IS FOUND IN

There are two distinct international market opportunities for baobab products. One is for baobab powder (sometimes called "baobab fruit pulp", created from dried and ground baobab fruit) as a **food and beverage ingredient**, often marketed as a superfood due to its richness in vitamin C and fibres (Caluwé *et al.*, 2010; Ecovia Intelligence, 2021a; Gebauer *et al.*, 2016). The second is for baobab seed oil as a **cosmetic ingredient** (G. Le Breton, African Baobab Alliance, *in litt*. to C. Schindler, 26 May 2021).

Seeds, leaves, and flowers are also consumed locally as food (Caluwé *et al.*, 2010; Fern, 2019; Rashford, 2015; Sidibe and Williams, 2002). Roots, bark, and leaf extracts are used locally in medicine (Namratha and Sahithi, 2015).

OTHER RELEVANT SPECIES

Although there are multiple species of baobab, only *A. digitata* is native to mainland Africa and is the most widespread there (Wickens and Lowe, 2008).
Many other nutrient-dense wild tree fruits have been identified as "superfoods" or "superfruits" due to their high levels of essential nutrients and bioactive compounds. Some of the most well-known include: *Sclerocarya birrea, Boscia senegalensis, Tamarindus indica, Vitex doniana, Ziziphus mauritania, Uapaca kirkiana.* These species have high potential to contribute to a growing industry if sustainability concerns are addressed. More information on the nutritional value of these species is available in Stadlmayr *et al.* (2013) and from World Agroforestry's Priority Food Tree and Crop Food Composition Database (2021).

Baobab fruit ©Petr Kosina

PRODUCTION

Adansonia digitata is a large, deciduous tree with a hollow trunk that stores water throughout the dry season (RBG Kew, 2021b). It is a species of cultural importance across many African countries (*Ibid*.). There are three harvestable products from baobab: the fruit, the leaves, and the bark (World Agroforestry Center, 2011). Each is harvested at a different time of year and using a different technique.

The most commonly harvested plant part is the fruit. This is collected during the dry season (G. Le Breton, *in litt*., 26 May 2021). Harvesting takes place predominantly from the ground (*Ibid*.), although in some cases the fruit is hand-picked by children climbing the trees or by adults pulling off the fruits with a knife or hook mounted on a long bamboo cane (Buchmann *et al.*, 2010). The fruit yields two different products: the powdery fruit pulp and the seeds (African Baobab Alliance, n.d.).

Leaf harvesting takes place 1-2 weeks after the beginning of the rainy season when the young leaves emerge (G. Le Breton, *in litt*., 26 May 2021). The majority of leaf harvesting takes place from mature trees, although it is becoming more common now to raise young baobab saplings specifically for leaf production (*Ibid*.). During leaf collection from mature trees, the risk of an accident while climbing the trees is high due to the trees' height and soft, spongy wood (Buchmann *et al.*, 2010). Entire shoots are often broken off the tree, reducing the number of leaves, flowers, and fruits produced (*Ibid*.).

Bark harvesting occurs at any time of year (G. Le Breton, *in litt*., 26 May 2021). The bark is removed in square sections, often up to 50 cm x 50 cm, dried, and then used as fibre (*Ibid*.). The bark is only removed from areas of the tree accessible at ground level (*Ibid*.).

In 2019, 72 percent of the harvesters, wholesalers, processors and retailers in the supply chain of baobab in south-eastern Kenya were found to be female (Jäckering *et al.*, 2019). It is common for women to be assisted by their children in the baobab harvest as part of the daily routine of family chores (Buchmann *et al.*, 2010). In a study in northern Venda, South Africa (Venter and Witkowski, 2013), baobab fruit harvesters were mostly women (98 percent), many of whom had no other employment and with no formal education. The annual cash income received from baobab fruit made up 38 percent of the total yearly sales of all NWFPs in the study region (*Ibid*.). In other parts of southern Africa, the sale of baobab fruit for commercial purposes has been reported to increase the monthly cash income of individuals by 250 percent during the harvesting season (Gruenwald and Galizia, 2005).

When the baobab trees are not planted near villages, women and children may have to walk up to two hours to collect baobab fruits, leaves, and other useful parts from wild-growing trees. Social networking to ensure continuous access to privately owned baobab trees is done amongst women to save them the long walk to the baobab trees growing in the bushland (Buchmann *et al.*, 2010)

72 PERCENT
of harvesters, wholesalers, processors and retails of baobab in SE Kenya are female

TRADE

There are three distinct zones of production for baobab in Africa (Kamatou *et al.*, 2011):

- In West Africa, baobab is harvested for its leaves and fruit (G. Le Breton, *in litt*., 26 May 2021; Rashford, 2018). The biggest demand comes from the local market, although the region is also an important supplier to the European market (*Ibid*.; Ecovia Intelligence, 2021a). The major producers are Senegal, Ghana, Benin and Burkina Faso (*Ibid*.; Kamatou *et al.*, 2011; Ecovia Intelligence, 2021a).
- In East Africa, baobab is harvested for its fruit (G. Le Breton, *in litt*., 26 May 2021). Again, the primary demand is local, with Sudan having a particularly strong local market for baobab products (especially the powder as a beverage ingredient) (*Ibid*.).
- In Southern Africa, baobab is mostly harvested for its fruit and, in some cases, its bark (G. Le Breton, *in litt*., 26 May 2021). The main market demand for powder is for export, and the major producers are Zimbabwe, Mozambique and South Africa (*Ibid*.; Kamatou *et al.*, 2011).

DEMAND FOR BAOBAB IS INCREASING
as international consumers seek more natural health, food, and beauty products

The main European markets for baobab powder are UK, France, and Germany (Ecovia Intelligence, 2021b). Those countries have large consumer markets and a growing interest in the natural health product industry (*Ibid*.). The United States of America is also experiencing rapid growth in demand for baobab powder, driven largely by consumer interest in antioxidants (G. Le Breton, *in litt*., 26 May 2021). In those markets, the demand for nutritional supplements and organic products is increasing and is expected to continue growing in the coming years (Ecovia Intelligence, 2021a).

The markets for baobab seed oil are largely focused on manufacturing hubs in the cosmetics industry (G. Le Breton, *in litt*., 26 May 2021). The primary hub is France, although other centres include the United Kingdom, the United States of America, Germany and the Republic of Korea (*Ibid*.). Demand is almost entirely for organically-certified, cold-pressed baobab oil (*Ibid*.).

In international trade, Baobab powder has no unique HS code, which makes it difficult to monitor. It is currently traded under HS code 11063090 – 'flour, meal and powder of dried fruits, other than bananas'. Baobab powder accounts for about 2 percent of the total imports of fruit powder under this HS code (Ecovia Intelligence, 2021a).

According to the African Baobab Alliance, baobab powder exports reached 450 tonnes in 2017 (Ecovia Intelligence, 2021a). It is forecast that the exports of baobab will reach 5000 tonnes by 2025 (Bulletin Line, 2020).

Anecdotally, prices for Baobab fruit pulp were reported as follows in December 2020:

- Retail: approximately USD 32 per kg.
- Wholesale: approximately USD 15 per kg.
- Supplier: approximately USD 7 to USD 10 per kg (without the shipping costs) in average quality, depending upon the quantity, quality, and other trade terms, and organic/FairTrade/other factors; with certification costs, this export price may rise to around USD 12 per kg.

(G. Le Breton, *in litt*., 26 May 2021)

In May 2021, the prices before shipping were USD 7-12 per kilogramme for baobab powder (*Ibid*.) and USD 30-60 per kilogramme for baobab seed oil (Ecovia Intelligence, 2021a).

RISKS

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- Trees tend to grow as solitary individuals (Rahul *et al.*, 2015), meaning that **populations are scattered thinly** across the species' range.
- The species has **multiple uses** (Cuni Sanchez *et al.*, 2011) and trade is increasing (Kamatou *et al.*, 2011).
- The species' **conservation status has not yet been evaluated** on a global scale.
- Its **reproduction** is sexual, meaning it relies on pollinators (mainly bats, flies, moths, and the bush baby lemur) to reproduce (World Agroforestry Center, 2018). Fruit harvesting impacts dispersal and establishment of seedlings, while leaf harvesting can cause damage that reduces the number of fruits per tree (Cuni Sanchez *et al.*, 2011).
- It faces **a single major threat** across its range: land-use changes of a growing rural population (Schütt *et al.*, 2004). Additional threats, such as changes in hydrology in Zimbabwe, may be faced locally (Prota4u, n.d.).

Social:

Assessed for **South Africa**, **Ghana**, **Senegal**, and **Zimbabwe**, four of the top producing countries as **High** (Schindler, 2021), due to the following factors:

- With baobab harvesting often being a family activity, and each country having documented cases of **child labour** in other agricultural commodities, there is a high risk of child labour occurring throughout the baobab's range (Buchmann *et al.*, 2010; USDoL, 2019; USDoL, 2020).
- There is a high risk of accidents when climbing trees to harvest baobab leaves and other **health and safety** considerations when harvesters need to walk long distances to access baobab trees (Buchmann *et al.*, 2010; Prota4u, n.d.).
- In some cases where baobab trees are located on private land, there can be **access rights issues** and potential for **discrimination** (Buchmann *et al.*, 2010

There is additional risk in Zimbabwe due to allegations of violation of workers' right to freedom of association and collective bargaining, with reports by trade union organizations of violence against participants in general strikes and former union leaders being prosecuted and receiving violent threats (ITUC, 2020). Although this does not relate specifically to the baobab harvest, it is important to consider the implications this has on the ability of workers to represent their rights in Zimbabwe.

MEDIUM

biological risk

HIGH

social risk

South Africa, Ghana, Senegal, and Zimbabwe

Baobab seeds ©T.K. Naliaka/Wikimedia Commons

OPPORTUNITIES

Baobab presents an excellent opportunity to support development, female empowerment, and conservation efforts in some of the poorest countries in the world if sourced responsibly (FairWild, 2017; Sanogo *et al.*, 2020; World Economic Forum, 2021; Venter and Witkowski, 2013). Some specific opportunities include:

baobabs share habitat **WITH THE AFRICAN ELEPHANT**

Conservation and restoration

Protecting, planting, and sustainably harvesting baobab trees can aid in protecting a range of species that live amongst them. Baobab trees depend mostly on bats (*Ephormorphus wahlbergii* and *Rousettus aegyptiacus*) to pollinate the flowers. The smell of the flowers attracts the bats and other pollinators, such as the bluebottle fly *Chrysomyia marginalis* and nocturnal moths (*Heliothis armigera*, *Diparopsis castanea* and *Earias biplaga*). In East Africa, the bush baby *Galago crassicaudatus* feeds nocturnally on the flowers, thus aiding in pollination (World Agroforestry Center, 2018). Baobab trees also share their habitats with the African Elephant *Loxodonta africana* – for example, the Kavango Zambezi Transfrontier Conservation Area overlaps with baobab's range and is a critical elephant migration route, as well as a hotspot for poaching and trafficking (Prinsloo *et al.*, 2021). A number of conservation efforts are already underway, such as:

- Baobab planting occurs in Ghana and Burkina Faso to support women's livelihoods in the dry season and contribute to the Great Green Wall Project, which aims to restore 1 million km2 of degraded land and halt the expansion of the Sahara desert by 2030 (World Economic Forum, 2021; FAO, 2021).
- In Daga Birame, Kaffrine Region, Senegal, baobab trees formed part of a 'climate-smart village approach': identifying socially and ecologically responsible farming practices via participatory development with local land managers to develop context-specific land management practices (Sanogo *et al.*, 2020). The aim was "to transform agricultural systems, so they effectively ensure food security and support livelihoods in a changing climate" (*Ibid*., p.2). Baobab trees were protected and planted as part of the approach, while processing and marketing baobab fruit powder ensured that women were engaged (*Ibid*.). The project demonstrated the importance of involving local communities, at all sociocultural and organizational levels, in sustainable land management towards broader efforts of re-greening the Sahel region (*Ibid*.)

Partnerships and associations

Baobab presents an excellent opportunity to support development and female empowerment in some of the poorest countries in the world if sourced responsibly (FairWild, 2017). Existing unions and initiatives can be supported where they exist. The African Baobab Alliance is the main industry association. They work on regulations, supporting the harvesters and promoting baobab on different markets. See http://africanbaobaballiance.org/

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. Certification schemes can offer a price premium for producers, and have proven popular particularly in European markets; for example, EU Organic, Ecocert Fair Trade, Fair for Life, FairWild, UEBT and ABS certification (Ecovia Intelligence, 2021a and 2021b). FairWild has certified baobab products in the market from the brands B'Ayoba and EcoProducts (Ecovia Intelligence, 2021a).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

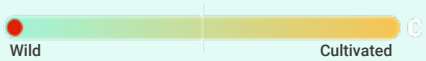
BRAZIL NUT,
Bertholletia excelsa Bonpl.

BRAZIL NUT, *Bertholletia excelsa* Bonpl.

NAMED IN INGREDIENTS AS

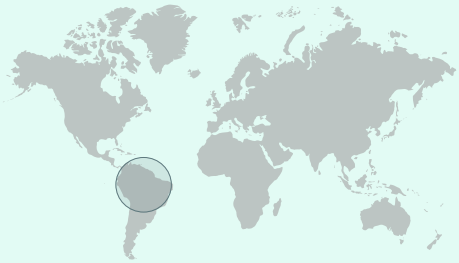
Brazil nut

WILD-HARVESTED VS CULTIVATED



Wild (Peru Ministerio del Ambiente, 2014)

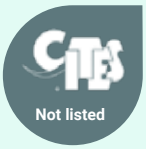
DISTRIBUTION



Bolivia, Brazil, Colombia, French Guiana, Guyana, Peru, Suriname, Venezuela (RBG Kew Science, n.d.)

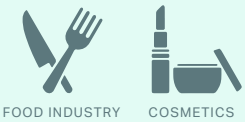
GLOBAL CONSERVATION STATUS

IUCN: Vulnerable, needs updating (Oldfield *et al.*, 1998).



CITES: Not listed

PRODUCTS IT IS FOUND IN



Brazil nuts are primarily consumed as **food**, and to a lesser extent, are also processed into oil for use in the cosmetics sector (UNCTAD, 2005).

OTHER RELEVANT SPECIES

The Brazil nut tree is part of the complex Amazon rainforest ecosystem, involving other plants, animals, and insects that all facilitate fruit production, and who therefore benefit from conservation of the Brazil nut tree. Cross-pollination of the flowers by non-social bees is essential to fruit production (Mori, 1992). The agouti, a rodent with extremely powerful jaws and sharp teeth, plays a critical role in the dispersion of the seeds, as they are one of the only animals capable of breaking open the hard seed case (Ortiz, 2002). Without a diverse forest ecosystem, the Brazil nut tree would struggle to produce and disperse seeds, and therefore to survive. This is why cultivation efforts have not been successful – the trees depend on a primary tropical forest ecosystem to reproduce (Evans, 2013).

Brazil nut fruits ©Marco Simola/CIFOR

PRODUCTION

Bertholletia excelsa is a tall tree found within the Amazonian rainforest ecosystem that is primarily exploited for its edible nuts. Harvesting is concentrated in three countries: Brazil, Bolivia, and Peru (Sorrenti *et al.*, forthcoming). As a wild crop, annual yield of Brazil nut is unpredictable and environmental factors (such as temperature and rainfall) can have significant implications (Peru Ministerio del Ambiente, 2014).

The collection period varies according to the locations of occurrence. In Brazil, in the State of Mato Grosso, the harvest starts in November and ends in March; in Pará, harvest occurs from January to April; in Amapá, from January to May; in Acre, from December to February (COOPAVAM, 2016). In the Peruvian Amazon, the harvest period occurs between January and April. These periods can vary depending on annual climate variations (Peru Ministerio del Ambiente, 2014).

The harvesting of the nuts in the forest is carried out manually by harvesters called "zafreros", "barriqueros" or "castañeros". The harvesters wait for the rains to make the nuts fall. Generally, the rains are concentrated in December-early March. Work to prepare roads and collection routes occurs in advance, in November. The harvesters' tactic is to have 80-90 percent of the nuts on the ground before going into the forest. This is both for safety (a 2 kg shell falling from 35m height can be deadly) and to reduce logistics costs. Once collected, initial processing of the nuts occurs by splitting the hard mesocarp or inner shell, often manually with machetes, separating the nuts from their shell (Zuidema, 2003; COOPAVAM, 2016; Peru Ministerio del Ambiente, 2014; AEMP, 2021).

A balance must be struck between collection volume and the length of time on the ground (Perez, 2013; AEMP, 2021). Ideally, the nuts should be collected daily to reduce the chances of contamination by fungi and other microorganisms (such as aflatoxins) present in the soil, since rain and high humidity are common in the Amazon region (COOPAVAM, 2016). When the nuts are not processed on the same day they are harvested, they must be placed in a pylon (a wooden frame, similar to a drying table), with the opening facing down to allow ventilation, reduction of moisture, and elimination of water to reduce the chances of contamination (COOPAVAM, 2016).

Within the regional economy, the Brazil nut provides a substantial income for many families, creating employment in an otherwise impoverished region (Zuidema, 2003). Production constitutes one of the largest activities of economic significance and generates many jobs through its various stages. About 25 percent of the Madre de Dios region of Brazil's population depends directly and indirectly on this activity - approximately

Brazil nuts provide **CRITICAL INCOME** in impoverished regions

20 000 inhabitants, of which it is estimated that around 10 000 people's livelihoods are linked solely to the collection of the nut. In addition, for families with a nut concession, this fruit contributes 67 percent of their total annual family income (MINAGRI, 2008 and IIAP, 2001, cited in Cabezas Loayza, 2018).

Brazil nut resource users are spread across different tenure types, including indigenous reserves, extractive reserves and other government-sanctioned protected areas, government-sanctioned concessions, and communal and individual private property (Guariguata *et al.*, 2017). Where harvesting occurs on private land, the collection can be arranged either by the landowner directly, or by subcontracting their land (Perú Ministerio del Ambiente, 2014).

some Brazil nut harvesters live seasonally in temporary camps with

POOR LIVING CONDITIONS

NGOs have supported Brazil nut harvesters to form cooperatives and, in some cases, to help them develop processing plants owned by producers or to achieve various certifications (Mathews and Schmink, 2015). Nut harvesters live during harvest season on rural properties connected via trails to Brazil nut trees, where they harvest the fruits from the forest floor. With the recognition of forest property rights, many of these families have gained more autonomy by managing their resources, often within communal properties or with individual rights, as in Peruvian Brazil nut concessions. In the remaining large tracts of Brazilian nut-rich forest, claimed as private property or granted as logging concessions, contract labour is used. In such cases, many families continue to provide migrant labour (especially in Bolivia), with entire families including children coming from neighbouring regions to participate in the harvest while living in temporary forest camps (Guariguata *et al.*, 2017). Conditions in these remote camps can be poor, with inadequate housing and no access to clean drinking water (SOMO, 2021).

Brazil nut harvest is frequently conducted without a contract and through informal employment, which can lead to low or inconsistent pay for harvesters (Guariguata *et al.*, 2017).There is also evidence of forced labour situations in Bolivia. For example, 88 percent of farmworkers said they took out loans from their employer in the form of advance payments. This makes it difficult for workers to quit their jobs. In more extreme cases, workers said they had to do harvesting work to pay off last season's debts to their employers (SOMO, 2021).

Indigenous groups are also involved in the harvest. Traditionally, Kayapó Indigenous people of south-eastern Amazonia planted *B. excelsa* seeds in their territories. The dispersal of *B. excelsa* throughout the Amazon has been, at least in part, influenced by indigenous groups and strongly suggests that current human activities are contributing to the maintenance and formation of *B. excelsa* groves (Ribeiro *et al.*, 2014).

The production of Brazil nuts requires management plans in Bolivia, Brazil, and Peru. Some countries have specific regulations to standardize production through the collection and classification of nuts, from the identification and mapping of the areas of occurrence, to the number of trees per known region by the harvesters, how the seeds are collected, and how the processing will occur to obtain a quality nut (COOPAVAM, 2016).

Brazil nuts ©Pixabay

TRADE

After initial drying, Brazil nuts can either be sold on to an intermediary/aggregator, to processing companies, or to exporters/traders. In years of good prices, Brazil nuts can be sold shelled (requiring an additional processing step) or in their shell, while exporting companies prefer to buy shelled Brazil nuts in years of low prices. The nuts are sold by exporters/traders to food companies in importing countries in charge of the packaging for retail companies, or directly to supermarkets when the trading companies own packaging facilities. There are no processing steps between the producing countries and the supermarkets; however, the cost increases about 2.5 times (SOMO, 2021). 35 000 tonnes of Brazil nuts were estimated to be consumed in 2018 by the world's twenty leading consumer countries, a modest amount in comparison with the estimated 2018 consumption of most other tree nuts by these twenty countries, such as almonds (1 304 051 tonnes), walnuts (887731 tonnes), and cashews (720 170 tonnes) (INC, 2021). In 2018, the majority of the total world production of Brazil nuts came from Brazil and Bolivia, representing 48 percent and 43 percent of total world production respectively (Sorrenti *et al.*, forthcoming). Brazil is the leader of in-shell nut production, as demonstrated in Figure 4, whereas Bolivia and Peru lead shelled nut production (contributing 78 percent and 16 percent respectively on average to global production between 2014-2019) (INC, 2021; Sorrenti *et al.*, forthcoming).

35,000 TONNES
amount of brazil nus consumed by just 20 leading consumer countries in 2018

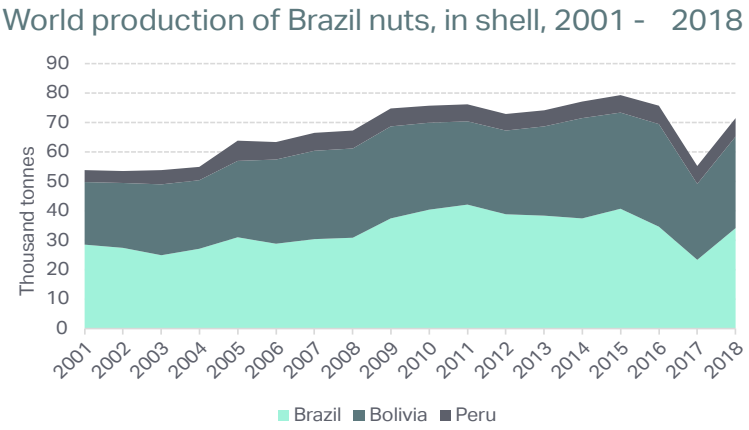


FIGURE 4

The different colours represent the proportion that each country has contributed to total global production
Sources: Sorrenti *et al.*, forthcoming; Peru – FAOSTAT estimates; Bolivia – FAOSTAT official data and 2018 estimate; Brazil - from 2001 to 2015 FAOSTAT official data; 2016-2018 Instituto Brasileiro de Geografia e Estatistica (IBGE).

Brazil nut prices have been relatively steady in the decade from 2010-2020, as demonstrated in Table 6

YEARLY PERIOD	2009/10	10/11	11/12	12/13	13/14	14/15	15/16	17/18	18/19	19/20
MILLIONS USD	180	210	180	170	190	240	230	230	340	200
INFLATION-ADJUSTED (MILLIONS USD)	214	242	203	189	208	262	248	237	344	200

TABLE 6

Supply value of Brazil nut kernels (nuts, shelled) in millions USD. 'Supply value is estimated as the production per its unitary monthly price averaged annually (customs paid upon arrival in Europe)'
Source: INC, 2021, p.13

RISKS

biological risk

social risk

Brazil and Bolivia

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- The species is globally classified as **Vulnerable** (IUCN, 2020).
- **Habitat specificity**: It is adapted to one specific habitat type (Ortiz, 2002).
- It is reliant on specific species for **reproduction**: non-social bees for pollination (Mori, 1992), and agouti for seed dispersal (Ortiz, 2002).
- It is facing a **single major threat:** significant habitat loss due to deforestation (Oldfield *et al.*, 1998; Martinelli and Avila Moraes, 2013).

Brazil nut trees have experienced major declines in their population because of deforestation (Oldfield *et al.*, 1998). In Brazil, timber extraction contributes to its decline, projected in 2013 to be 30 percent over the next 100 years (Martinelli and Avila Moraes, 2013). Little is known about the impact of seed gathering on regeneration, but it has been demonstrated to be detrimental under some harvesting regimes, for example, when agoutis, which are critical for seed dispersion, are hunted or scared away (Oldfield *et al.*, 1998). Some areas that have experienced long and intensive harvest pressure show evidence of a recruitment bottleneck, meaning a lack of young or pre-reproductive trees replacing the oldest (Peres *et al.*, 2003). However, if seed collection caused a recruitment bottleneck, it could take several decades and possibly up to a century to cause a decline in Brazil nut productivity (Zuidema and Boot, 2002).

Social:

Assessed for **Brazil** and **Bolivia**, the top producing countries (Sorrenti *et al.*, forthcoming), as **High** (Schindler, 2021), due to the following factors:

- **Child labour** and **modern slavery** have been documented in Brazil nut harvesting, the latter in Bolivia in particular (Walk Free Foundation, 2018; USDoL, 2020; SOMO, 2021). These critical risks should be investigated no matter where sourcing is occurring, given that the product is harvested in the same way by similar groups in neighbouring countries.
- Brazil was named one of the world's ten worst countries for workers in a 2020 report due to its multiple violations of **workers' rights to freedom of association** and collective bargaining. There has been violent action against strikes, with trade union leaders arbitrarily arrested and receiving violent threats against their lives. A president of a rural workers' trade union was killed in 2019 (ITUC, 2020). Therefore, in Brazil, violation of workers' rights is a risk.
- A number of **vulnerable** groups are involved in the harvest of Brazil nuts, including migrant labour, contract labour, a high proportion of women at the processing stage, and Indigenous People, resulting in greater opportunities to abuse worker rights (INC, 2017; Gariguata, 2017).
- In Brazil, *B. excelsa* trees are located on land under various types of ownership, potentially resulting in **access rights issues** and opportunities for **discrimination** (Guariguata *et al.*, 2017).
- Finally, the harvest involves a myriad of **health and safety** issues, including insect bites, parasite infections from unsafe drinking water at forest camps, snake or scorpion stings, attacks from wild animals like the jaguar, and risk of death from heavy falling fruit (SOMO, 2021).

A brazil nut harvester at work ©Marco Simola/CIFOR

OPPORTUNITIES

Conservation and restoration

There is a clear opportunity to support wider Amazon rainforest conservation efforts through protection and sustainable harvesting of the Brazil nut tree. The Amazon region is widely known to be one of the most biodiverse areas on Earth, yet is threatened by rapid deforestation rates (Martinelli and Avila Moraes, 2013). By protecting Brazil nut trees, there is also the opportunity to protect those species that pollinate it and disperse its seeds, namely non-social bees (Mori, 1992) and the agouti rodent (Ortiz, 2002). The trees' protection would simultaneously safeguard the livelihoods of those depending on Brazil nut harvest for their families' income, while contributing towards a stable supply of Brazil nuts into the future.

Partnerships and associations

There is a wide range of stakeholders already working towards responsible sourcing of Brazil nuts, which can be allied with to ensure that responsible sourcing efforts are meaningful and beneficial to local people. In Bolivia, the following are important producer unions: ASPROGOAL (Association of Rubber and Almond Producers), AARENAMAPA (Agroindustrial Association of Natural Resources of the Manuripi River in Pando).

In Brazil, the following are relevant stakeholders:

- Institute for the Conservation of Biodiversity (ICMBio), a local NGO that supports local harvesters
- Cerratinga is conducting capacity building in the region on the great potential of use of biodiversity resources. They are also creating support tools for community production initiatives, which promote income generation and social inclusion.
- ABNC- Asociación Brasileña de Nueces supports growth of sustainable production with social responsibility involving the entire production chain, and encourages the consumption of nuts, Brazil nuts and dried fruits. Inicio - ABNC (abncnuts.org.br)
- Cooperative in north-west of Brazil - COOPAVAM | Cooperativa dos Agricultores do Vale do Amanhacer
- Finally, the Sustainable Nut Initiative (SNI) is an organization working with major supermarkets Aldi and Lidl towards

responsible nut supply chains, including the Brazil nut (SOMO, 2021).

Standards and certification

The two main certifications in the Brazil nut industry are organic and fair trade. Organic certification can help to secure a fair price for the raw material from the exporting company as there is less supply available (Tenorio, 2018). Fairtrade certification can allow small producer groups to sell directly to buyers in foreign markets which can offer price premiums (Guariguata *et al.*, 2017). Fairtrade also creates a minimum price 'safety net' and requires buyers to contribute to a premium fund to be spent by the producer community (Fairtrade, n.d.). However, Fairtrade does not guarantee the maintenance of biodiversity (Tenorio, 2018).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

Brazil nuts ©P. S. Sena/Wikimedia Commons

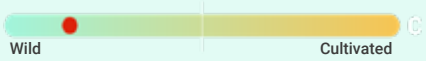
LIQUORICE,
Glycyrrhiza glabra L.

LIQUORICE, *Glycyrrhiza glabra* L.

NAMED IN INGREDIENTS AS

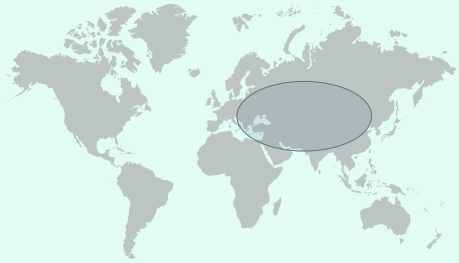
Liquorice

WILD-HARVESTED VS CULTIVATED



Mostly wild, although some is cultivated, depending on the source country (Brinckmann, 2020; Chen *et al.*, 2014).

DISTRIBUTION

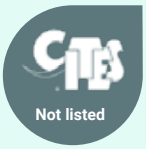


NOTE for review: map represents native range

Glycyrrhiza glabra is native to Afghanistan, Albania, Bulgaria, China, Cyprus, Greece, Iran, Iraq, Italy, Kazakhstan, Kyrgyzstan, Lebanon, Mongolia, Pakistan, Palestine, Romania, the Russian Federation, Saudi Arabia, the Syrian Arab Republic, Tajikistan, Turkey, Turkmenistan, Ukraine, Uzbekistan. It is introduced into Algeria, Australia, Austria, Bangladesh, the Czech Republic and Slovakia, Egypt, France, Hungary, Maldives, Portugal, South Africa, Spain, Switzerland (RBG Kew, 2020; GBIF Secretariat, 2021).

GLOBAL CONSERVATION STATUS

IUCN: : Least Concern (Chadburn, 2014).



CITES: Not listed

PRODUCTS IT IS FOUND IN

The **tobacco industry** is among the largest importers and users of liquorice, where it is used as a taste additive in tobacco products (Why Go Wild, n.d.). It is also used internationally as **medicine** (in several natural and traditional medicine systems including traditional Chinese medicine), as **food** (often found in candy, beverages, and teas), and in **cosmetics** (CPC, 2015; EPC, 2020; USPC, 2020; Why Go Wild, n.d.).

OTHER RELEVANT SPECIES

While this profile focuses on *Glycyrrhiza glabra* L., two additional species of liquorice popular in trade are referred to throughout: *Glycyrrhiza inflata* Bat. and *Glycyrrhiza uralensis* Fisch. (EMA, 2012; EPC, 2020).

In addition to these three, other species are in trade, such as *Glycyrrhiza echinata* L., *Glycyrrhiza korshinskyi* Grig. (McGuffin *et al.*, 2000), and *Glycyrrhiza pallidiflora* Maxim. (EC, 2021). Species are usually harvested and traded simply as 'liquorice' and not distinguished between.

PRODUCTION

Glycyrrhiza glabra is a widespread perennial herb that is primarily harvested for its rhizomes, which contain the sweet compound glycyrrhizin (RBG Kew, 2020). It is native to Eurasia, northern Africa and western Asia (*Ibid*.). The leading producers of wild-collected liquorice root (including all Glycyrrhiza spp.) for the global market include Afghanistan, Pakistan, Uzbekistan, Turkmenistan, Kazakhstan, Armenia, Azerbaijan, Georgia, and China (Brinckmann, 2020).

Liquorice harvesting is a seasonal activity. In the Caucasus countries (for example Georgia), wild liquorice root is harvested, depending on the weather, from as early as March to July and again from September to November. In Kazakhstan, harvesting begins around May and may occur continuously until late October or early November, depending on the weather. Harvesting in Uzbekistan ranges from May until August (J. Brinckmann, Traditional Medicinals, *in litt*. to C. Schindler, 27 May 2021). In China, wild liquorice is harvested in the spring or the autumn (CPC 2015).

The regeneration time for the roots is between three-five years (Anon, 2015). Therefore, liquorice roots are typically harvested on a three to five-year rotation – the longer the rotation, the larger the root yield (CBI, 2021b; Dastagir and Rizvi, 2005; Marui *et al.*, 2012).

Roots usually grow to between 2-3.5 meters in depth, and harvesters normally only collect roots from the first meter to allow for regrowth of the plant from the remaining rhizomes (Douglas *et al.*, 2004). In many areas, roots are dug by hand with shovels, but in more commercial operations, a tractor is used to plough a shallow trench in the soil to a depth between 40-60cm and the rhizomes are collected by hand from the trench (Douglas *et al.*, 2004; Gemedzhieva *et al.*, 2021). The harvested roots and rhizomes should be 5 to 50 mm (or more) thick, and the length can also vary. Root washing, drying and cutting occur before the product enters the supply chain (Gemedzhieva *et al.*, 2021).

Liquorice processing can be divided into three types depending on the end product and the sector. Primary processing is simple and consists of the basic slicing of dried roots, for use, for example, in traditional Chinese medicine (TCM) decoctions. Further particle size reduction is carried out for other purposes, such as cut and sifted pieces for loose pack teas, dense tea-bag-cut particle size for filling into tea bags, or powder particle sizes for filling into capsules (J. Brinckmann, *in litt*., 28 May 2021). The second involves producing liquid and dry extracts using various extraction technologies and solvent systems (*Ibid*.). For TCM, only water is used

THREE TO FIVE YEARS
typical regeneration time for liquorice roots

Liquorice plant ©Юрий Данилевский/Wikimedia Commons

there is a **SIGNIFICANT LACK OF INFORMATION** on liquorice harvesters

as the extraction solvent (*Ibid*.). The third type produces glycyrrhizic acid and involves a more complicated chemical reaction (Chen *et al.*, 2014). According to the US Food and Drug Administration (FDA) regulations, "ammoniated glycyrrhizin" is prepared from the water extract of liquorice root by acid precipitation followed by neutralization with dilute ammonia. "Monoammonium glycyrrhizinate" is prepared from ammoniated glycyrrhizin by solvent extraction and separation techniques (US FDA, 2020).

Limited information is available on producers in liquorice-producing countries, and further social research is needed. In Kazakhstan, most wild liquorice harvesters are from rural villages, typically with low income, where the yearly harvest of wild roots is their only stable source of income. The only option to maximize income is to harvest as much as possible, sometimes at unsustainable rates. Much of the harvest is traded internationally through supply chains of varying levels of legality. Wild liquorice harvesters in Kazakhstan are predominantly male (10 percent women), with female participation increasing in liquorice processing (40 percent women) (Gemedzhieva *et al.*, 2021).

When considering the people involved in liquorice harvesting, it is vital to consider geopolitical issues in some of the source countries (such as Afghanistan and Iraq), as well as the remoteness of many of the harvesting regions (Brinckmann, 2020).

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TRADE

The majority of liquorice root (all *Glycyrrhiza* spp.) harvested from the wild comes from Uzbekistan and Azerbaijan, with smaller quantities from Armenia, Georgia, Tajikistan, Turkmenistan, Kazakhstan, and Kyrgyzstan; north-western areas of China; Afghanistan, Pakistan, Iran, Iraq, and the Syrian Arab Republic. Wild collection of liquorice also takes place in Europe, primarily in Italy, Spain, and Turkey (Brinckmann, 2020).

For the liquorice that reaches the European marketplace, the processing and extraction steps often occur in China or Iran, occasionally in Europe. Specialized machinery and skilled workers distil liquorice roots into an extract, especially when the final destination for the extract will be cosmetics. Harvesting and processing sometimes take place in separate countries, with the result that some countries can appear as big players in the liquorice trade without growing a significant amount of liquorice within their borders. This can also make liquorice traceability challenging (CBI, 2021a).

Based on UN Comtrade data, the global exports of liquorice commodities between 2009 and 2018 totalled more than 246 234 tonnes, valued at more than USD 1.735 billion. 88 countries/territories reported exporting liquorice commodities, and 153 countries/territories reported importing liquorice commodities between 2009 and 2018, while more than 95 percent of all exports were reported as vegetable saps and extracts of liquorice (HS 130212) (UN Comtrade, 2021).

The top three exporters/re-exporters (Iran, the United States of America and China) between 2009 and 2018 reported just under half of all global exports (50 percent), and the top ten exporters reported more than 94 percent of all global exports of liquorice. Liquorice extract export increased between 2009 and 2018, from a minimum of 20 938 tonnes in 2009 to a high of 30 651 tonnes in 2017 (UN Comtrade, 2021). The main importing countries from 2013 to 2020 for liquorice root are the United States (14 percent of total imports), Germany (12 percent), and Japan (8 percent) (Tridge Market Intelligence, 2020).

Demand for liquorice is likely to increase due to the COVID-19 pandemic, as the official treatments issued by the National Health Commission of the Republic of China include both TCM and Western treatments, with liquorice featured in the TCM formulations (Timoshyna *et al.*, 2020).
Liquorice used for medicinal purposes (pharmacopoeial quality) is more expensive than liquorice used for other sectors such as the food industry as a sweetener or the tobacco industry (Hayashi and Sudo, 2009). The extract price began to go up after 2008 with increased imports into China, Japan, and Korea. For example, the cost of extracts reached USD 7.23/kg (EUR 4.98/kg) in 2011 from USD 5.12/kg (EUR 3.25/kg) in 2008 (Chen *et al.*, 2014; originally reported in EUR and converted to USD using rates on 30 June of the year referenced). Where used as food, many countries have food safety standards for liquorice regarding the glycyrrhizin content (for example the European Union and the United States of America).

The import price of liquorice from China has been increasing for several years. In particular, the significant rise in the price of imported Chinese liquorice after 2012 is notable, with the price in 2015 being nearly three times that in 2007 (without inflation adjustments) (Oishia, 2017). Because of the increased number of applications in the cosmetics industry, the cost of liquorice is rising, which represents an opportunity for suppliers in developing countries (CBI, 2021a).

60%
decline in China's liquorice population between 1980 and 2009.

RISKS

biological risk

social risk
Azerbaijan,
Uzbekistan and China

social risk
Iran and Turkmenistan

Biological:

Assessed as **Low** (Schippmann and Leaman, 2021) due to the following factors:

- The plant's roots are used and it can therefore be **destroyed through collection** (Saxena, 2005).
- It reproduces sexually via insect pollination, but insects that can pollinate it are common (Plants for a Future, n.d.).
- It has **multiple well-documented uses** (Ecovia Intelligence, 2020) and demand is increasing (Chen *et al.*, 2014).
- However, the species is internationally widespread (RBG Kew Science, 2020), adapted to various habitat types (Gemedzhieva *et al.*, 2021), can regenerate relatively easily through its roots and rhizomes (Ecocrop, n.d.), and has no known major threats across its entire range (Chadburn, 2014).

Liquorice populations in China decreased by 60 percent between 1980 and 2009. Land conversion is the most significant factor causing a decline in wild liquorice in China (Leung, 2009), although it was nevertheless assessed nationally as Least Concern in 2013 (Chinese Academy of Sciences, 2013).
In Kazakhstan, destructive root harvesting practices, including the use of tractors to uproot entire liquorice stands and overly frequent harvesting, can seriously harm wild populations which, in turn, can affect local ecosystems including tugai vegetation such as *Tamarix Tamaricaceae* spp. and *Halimodendron halodendron*. This habitat destruction can affect the soil structure and increase soil erosion (Gemedzhieva *et al.*, 2021).

Social:

Assessed for the top producing countries as follows:
Azerbaijan, Uzbekistan, China: **Medium** (Schindler, 2021)
Iran, Turkmenistan: **High** (Schindler, 2021)

These ratings are due to the following factors:

- Iran was rated higher risk because of high rates of **modern slavery** recorded in the country (Walk Free Foundation, 2018), while Turkmenistan is assessed as high risk due to its high levels of corruption (Transparency International, 2021).
- Turkmenistan and Uzbekistan also have concerning rates of **modern slavery** which warrant a more cautious due diligence approach (Walk Free Foundation, 2018).
- Workers in Iran experience frequent violations of their **right to freedom of association** and collective bargaining (ITUC, 2020).
- Azerbaijan has documented cases of **child labour** in similar activities such as farming and harvesting of tea, tobacco, and potatoes (US Department of Labour, 2019). Although these issues are not tied directly to the liquorice harvest, they are important factors to consider when sourcing from these regions.
- Specific to liquorice harvesting, as previously noted, the findings are sparse. In terms of **health and safety**, liquorice processing can be complex and require machinery, depending on the desired end product, requiring the provision of training and safety equipment (Chen *et al.*, 2014).

Social research on liquorice harvesters is sparse, particularly considering the plant's wide range. Wild liquorice usually comes from remote areas, is harvested by vulnerable populations, and has limited traceability (Brinckmann, 2020). Taking Kazakhstan as an example, harvesters are usually from low-income rural communities that depend on the annual liquorice harvest for their livelihoods (Gemedzhieva *et al.*, 2021). Therefore, regardless of the source country or the risk findings of this assessment, due diligence should be undertaken in liquorice sourcing.

Collecting Liquorice ©J.A. Brinckmann

OPPORTUNITIES

Restoration

Liquorice is a pioneer species, meaning it helps re-establish overused or damaged land. Liquorice is a salt tolerant plant that could be used for remediation of abandoned salt-affected soils. The salinization of lands has become a major environmental issue in Central Asia and has been recognized as one of the most critical economic, social, and ecological problems (Dagar *et al.*, 2015; Kushiev *et al.*, 2005).

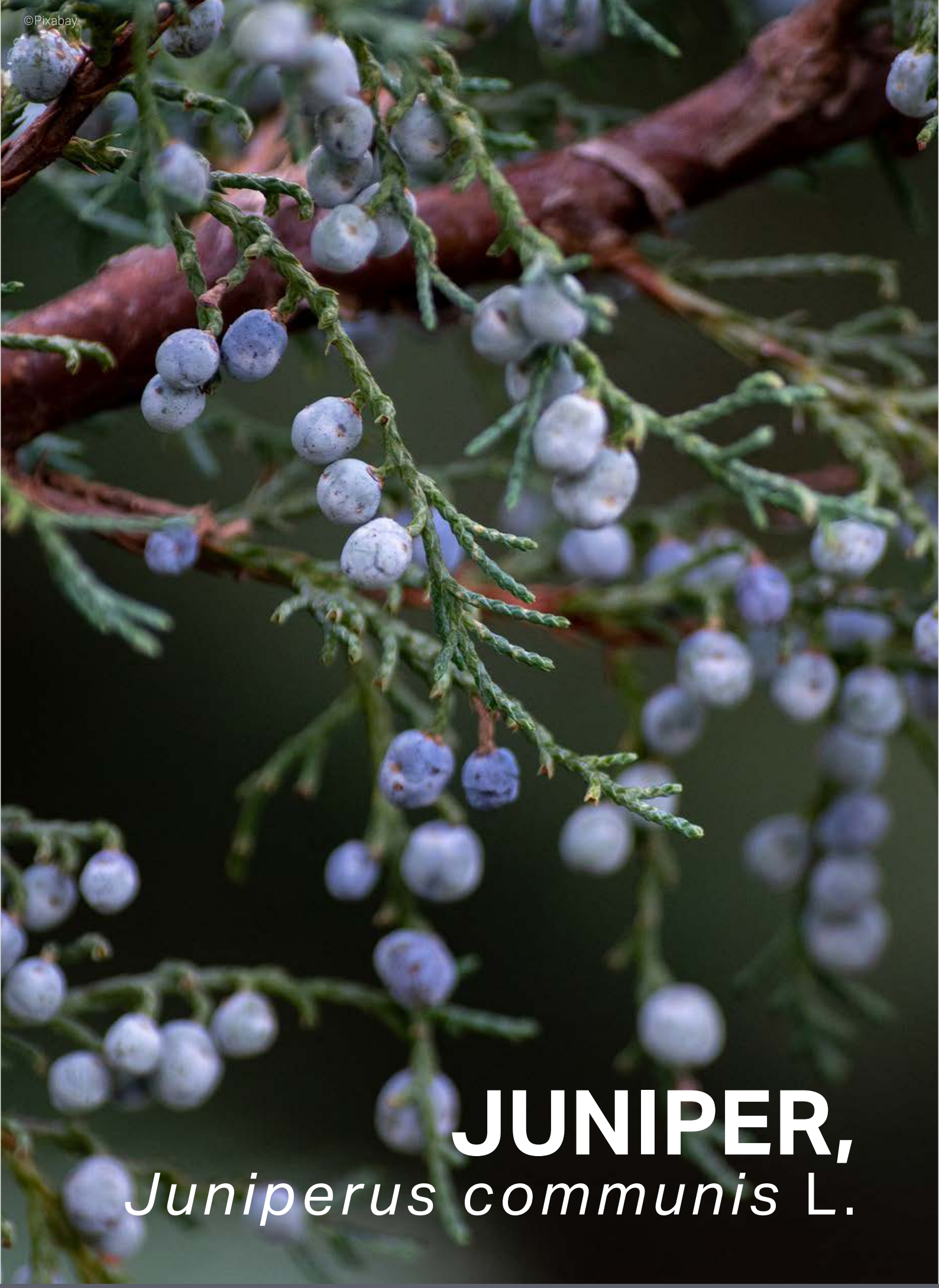
It is also a nitrogen-fixing plant, meaning it creates nitrogen through a symbiotic relationship with bacterial microorganisms in its roots. It typically produces an excess of nitrogen that neighbouring plants can use. Liquorice improves the soil nitrogen content, increases the soil organic matter, stimulates soil biological activity and improves soil water-holding capacity (Egamberdieva and Mamedov, 2015).

Standards and certification

Standards can provide an important reference point on how to address the complex risks associated with liquorice. Best-practice resource management is also important to consider in light of the recent spike in demand for liquorice due to COVID-19. A wide range of standards are available that can be applied to wild-harvested plants, such as organic, PEFC, FSC, Geographical Indication, FairWild, UEBT, FairTrade, and Fair for Life. Liquorice was one of the first products to be FairWild certified. Traditional Medicinals Inc. and Pukka Herbs Ltd., for example, both sell teas containing FairWild certified liquorice root (Lee, 2018). A description of the steps taken to achieve certified liquorice can be seen in Brinckmann, 2020.

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

©Unsplash
cardamone
réglisse



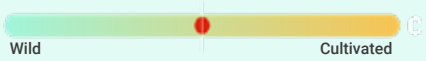
JUNIPER,
Juniperus communis L.

JUNIPER, *Juniperus communis* L.

NAMED IN INGREDIENTS AS

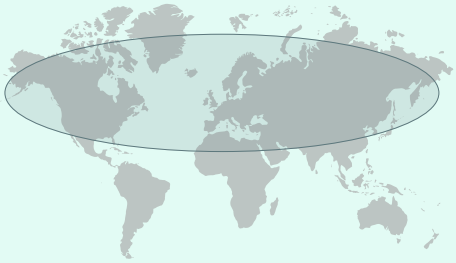
Juniper

WILD-HARVESTED VS CULTIVATED



Both wild and cultivated, although juniper destined for Europe and North America is mainly wild-collected (Engels, 2009).

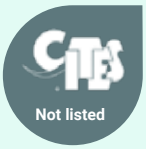
DISTRIBUTION



Juniperus communis is a species of the temperate and subarctic northern hemisphere. It is native in most of Europe, in the western parts of Northern Africa, in most of the Caucasus and Middle Asia, in Afghanistan, Pakistan, Nepal, China, the Russian Federation, Eastern Asia, and North America. Across its vast range, it has eight natural varieties and several bred cultivars differing in habit, growth form and intensity, colour and length of leaves, and so on.

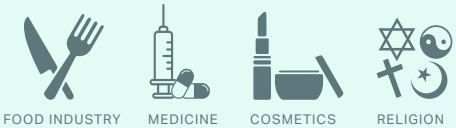
GLOBAL CONSERVATION STATUS

IUCN: : Least Concern (IUCN, 2020; Rivers *et al.*, 2019).



CITES: Not listed

PRODUCTS IT IS FOUND IN



Juniper berries are a key ingredient in **gin manufacturing**. They are also used as a **food flavouring**, an **essential oil**, an ingredient in **cosmetics**, and have a long history of use in **traditional medicines** and for **religious purposes** (Engels, 2009; Raina *et al.*, 2019; Rezvani *et al.*, 2009; Why Go Wild, n.d.).

OTHER RELEVANT SPECIES

There are between 52 and 67 juniper species in the world (Farjon, 2001; Adams, 2004). The most common juniper species in Central and Southeast Europe is *Juniperus communis* (Engels, 2009).

PRODUCTION

Juniperus communis is an evergreen shrub primarily exploited for its berries (Engels, 2009). Branches can also be harvested for their needles for the essential oil market (Raal *et al.*, 2010).

Juniper shrubs have a two to three year reproduction cycle, with the berries initially emerging as green and ripening to black over two years (Payne, 2017). The collection of the berry optimally occurs when the fruits are not ripe and not yet damaged: the berries need to be black and not green or brown. The collection period depends on the region: in the United Kingdom, it is usually between late September and late October, but occurs sooner in warmer climates, for example starting earlier in September and lasting a few months in Italy (Shelagh *et al.*, 2013; Payne, 2017). The harvesting takes time, with one person able to collect around 200 g in one hour (Shelagh *et al.*, 2013). Juniper shrubs can be struck or shaken to allow the ripe berries to fall off while leaving the majority of green, unripe berries for following years' harvests (Payne, 2017). Other methods like crushing the berries or using a comb are less productive, but assure a cleaner distillation for essential oil purposes (Varga *et al.*, 2012).

Central Europe (defined as the Czech Republic, Germany, Italy, Hungary, Austria, Poland, Slovenia and Slovakia) is an important region for the sourcing and collection of wild plants in general. However, since 1950, a decline has been observed in the traditional knowledge around harvesting and using many of these wild plants. Fewer young people are interested to learn about these wild plants due to urbanization, changes in land ownership, and lifestyle changes. Therefore, the collection of wild plants in Central Europe can sometimes be unsustainable, contributing to the further decline of an essential source of income for vulnerable groups. Roma populations and other ethnic minorities, and disadvantaged groups such as unemployed people, the elderly, and women, are involved in juniper harvesting in Central Europe (Rodina *et al.*, 2014).

Juniper picking in Italy is described as a family activity, with all family members taking part in some cases (Evans and Evans, 2009). The collection of juniper berries can be associated with other forest activities in Italy, such as truffle-hunting, and is often carried out by casual or opportunistic wild harvesters who live locally (Payne, 2017).

TRADITIONAL KNOWLEDGE
around harvesting wild plants has been declining in central Europe since 1950

Juniperus communis ©Ali Mohammad/Wikimedia Commons

Juniper spice ©Pixabay

TRADE

Juniper berry destined for Europe and North America is primarily sourced from wild collection in Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Hungary, Kosovo, Romania, Serbia, and Montenegro (Engels, 2009). For gin distillation, juniper berries are often harvested in Italy and the Balkans (Aylott, 2003).

Trade data in Europe are registered under the HS Code 0909 – Seeds of anise, badian, fennel, coriander, cumin, juniper berries (Eurostat, 2020). It is not possible to obtain accurate figures on the export of juniper berries because the HS Code is a general one assigned to several types of seeds and berries (Engels, 2009; Eurostat, 2020).

With a decreasing supply of juniper, the price has increased in recent years (Tarawneh *et al.*, 2020). An increasing amount of wild-harvested juniper is sold under organic certification (Engels, 2009).

The gin industry, one of the main users of juniper, has grown quickly in the last decade, but the COVID pandemic has slowed this trend. For example, UK gin exports dropped by approximately USD 137 million (GBP 100m) in 2020 to USD 781 million (GBP 572m),[6] which was partly attributed to the COVID pandemic and partly to the United Kingdom's exit from the EU. This trend may also affect the trade of juniper (Riley, 2021).

[6] Converted to USD using 31 December 2020 exchange rates

RISKS

Biological:

Assessed as **Medium** (Schippmann and Leaman, 2021) due to the following factors:

- **Regeneration** is slow and species is slow-growing (Jacquemart *et al.*, 2013). Seeds are slow to germinate and fruit takes two to three years to ripen (Payne, 2017).
- **Local population** sizes range from medium to large, but are not spread homogeneously across the species' range (Jacquemart *et al.*, 2013; Farjon, 2013).
- Species has **several well-documented uses** (Farjon, 2013).

This species is not threatened globally, although it is declining in some parts of its range (Farjon, 2013; Jacquemart *et al.*, 2020). Poor natural regeneration is the main threat to the long-term preservation of juniper populations across species range (Jacquemart *et al.*, 2020). Changes in land management leading to loss of low-intensity grazed grasslands may locally lead to population declines, as this is where juniper tends to thrive (*Ibid.*). The collection of berries may threaten only the female individuals of this dioecious species, and harvesting activities have not historically posed a threat, although they may be now (Thomas *et al.*, 2007; E. Németh, Hungarian University of Agriculture and Life Sciences - Department of Medicinal and Aromatic Plants, *in litt*. to C. Schindler, 1 June 2021).

Fungal disease, over-grazing, and over-harvesting threaten juniper populations despite their extensive range. Scotland has been affected by the spread of a deadly fungal disease called *Phytophthora austrocedrae* (McKeon, 2015). The unpredictable and erratic germination of juniper seeds also makes their cultivation difficult (Thomas *et al.*, 2007). In Hungary, in the last 20 years, severe damage to the trees has been observed in some locations by *Lamprodila festiva*, a wood-boring beetle, gnawing the plant under the bark (E. Németh, *in litt*., 1 June 2021).

Social:

Assessed for **eastern/central Europe** as **Medium** (Schindler, 2021) due to the following factors:

- Several **vulnerable** groups such as Roma, the unemployed, the elderly, and women participate in juniper harvesting (Rodina *et al.*, 2014). Vulnerable groups are at a higher risk of exploitation.
- There is documented rural-urban migration and a decrease of interest in wild plant harvesting, resulting in the loss of traditional knowledge and harvesting techniques for wild plants in eastern Europe. This, in turn, can result in unsustainable practices when harvesting does occur (Rodina *et al.*, 2014).
- There is some risk of **child labour,** especially in low-income, rural, or Roma communities; the risk varies by country (USDoL, 2019).

biological risk

social risk

eastern/central Europe

OPPORTUNITIES

JUNIPER PRICES HAVE INCREASED
in recent years as supply has decreased

Conservation and restoration

Through taking action to protect, and responsibly harvest, juniper, there is the opportunity to protect a much wider network of unique species dependent on it. Juniper forms important ecosystems, and its destruction can lead to the local extinction of associated flora and fauna (Ward and Shellswell, 2017). This is the case, for example, for the gall fly Schmidtiella gemmarum rubsaamen (Thomas *et al.*, 2007). Further, because of the juniper's natural resistance to drought, its planting could benefit regions stricken by a changing climate (McKeon, 2015).

Standards and certification

Certifications can be a supporting tool to ensure responsible sourcing. A list of those that can be applied to wild-harvested plants can be found in the Conclusion. Specific to juniper, FairWild and organic juniper are already on the market, and some producers have indicated their ability to gain certification if there was market demand. In national parks, controlled and sustainable collection may be organized by the directorate (E. Németh, *in litt*., 1 June 2021).

Common opportunities for all wild-harvested ingredients can be seen under Conclusion – What you can do.

Juniper berries ©Pixabay

RESULTS SUMMARY

Ingredient name	Used in	Species assessed	IUCN assessment	CITES status	Top producers/ exporters	Ecological risk rating	Social risk rating	Opportunity types
FRANKINCENSE, OLIBANUM	Beauty, medicine, aromatherapy, religion	*Boswellia sacra*	Lower Risk/ Near Threatened (1998)	Not listed	Somalia, Republic of Somaliland, Yemen, Oman	Medium	High	Research Partnerships and associations Conservation and restoration Standards and certification
PRUNUS, PYGEUM, AFRICAN CHERRY	Medicine	*Prunus africana*	Vulnerable (1998)	Appendix II (1995)	Cameroon, Uganda, Democratic Republic of Congo	Medium	High	Research Conservation and domestication Monitoring and data, Traditional knowledge, IPR and ABS Standards and certification
SHEA BUTTER, KARITÉ, BUTYROSPERMUM PARKII, VEGETABLE FATS (SHEA)	Beauty, food (chocolate)	*Vitellaria paradoxa*	Vulnerable (1998)	Not listed	Ghana, Burkina Faso, Cote d'Ivoire	Medium	High	Standards and certification Partnerships and associations Conservation and restoration
JATAMANSI, SPIKENARD, NARD	Medicine, aromatherapy, beauty	*Nardostachys jatamansi*	Critically endangered (2015)	Appendix II (1997)	Nepal	High	Medium	Standards and certification Partnerships and associations Health and safety Conservation
GUM ARABIC, ACACIA GUM, E414	Food and beverage, medicine	*Senegalia senegal*	Not assessed	Not listed	Sudan, Chad, Nigeria	Medium	High	Standards and certification Partnerships and associations Conservation and restoration
GOLDENSEAL	Medicine	*Hydrastis canadensis*	Vulnerable (2017)	Appendix II (1997)	The United States of America, Canada	High	Low	Partnerships and associations Conservation and restoration
CANDELILLA WAX, E902	Cosmetics, food, medicine, industrial	*Euphorbia antisyphilitica*	Not assessed	Appendix II (1975)	Mexico	Medium	High	Health and safety Partnerships and associations Standards and certification
ARGAN OIL, MOROCCAN OIL	Beauty, medicine, food	*Sideroxylon spinosum*	Vulnerable (2021)	Not listed	Morocco	Medium	High	Conservation and restoration Access and benefit sharing (ABS) Partnerships and associations Standards and certification
BAOBAB	Food and beverage, beauty	*Adansonia digitata*	Not assessed	Not listed	South Africa, Ghana, Senegal, Zimbabwe	Medium	High	Standards and certification Partnerships and associations Conservation and restoration
BRAZIL NUT	Food, cosmetics	*Bertholletia excelsa*	Vulnerable (1998)	Not listed	Brazil, Bolivia, Peru	Medium	High	Standards and certification Partnerships and associations Conservation and restoration
LIQUORICE	Tobacco, medicine, food and beverage, beauty	*Glycyrrhiza glabra*	Least concern (2014)	Not listed	Azerbaijan, Uzbekistan, China, Iran, Turkmenistan	Low	Azerbaijan, Uzbekistan, China: Medium Iran, Turkmenistan: High	Restoration Standards and certification
JUNIPER	Food and beverage, beauty, medicine, religion	*Juniperus communis*	Least concern (2019)	Not listed	Eastern and Central Europe	Medium	Medium	Conservation and restoration Standards and certification

Argan seeds ©David Brazier/B'Ayoba

CONCLUSION

WHAT YOU CAN DO

The profiles in this report focus on the Wild Dozen, a selection of wild-harvested ingredients chosen as flagships to represent the harvest methods, trade, risks, and opportunities that could face all types of wild-harvested plant ingredients.

Despite their geographical spread and use across vastly different industries (from beauty to food to aromatherapy to tobacco), there are a number of similarities amongst the risks and opportunities facing these ingredients. The important role these species place in the communities that harvest them is emphasized throughout. Risks around working conditions for harvesters, including health and safety, wages, and gender equality, are identified in most profiles, yet do not typically receive much attention in international supply chains. The importance of wild-harvested species to their surrounding ecosystems is repeatedly highlighted, including (in some cases) those species' ability to contribute to conservation or restoration efforts. Many partnerships and associations are noted that can be linked into to amplify social or biological improvement efforts.

Across the board, and beyond the Wild Dozen, more attention is required on wild plant ingredients from all stakeholders discussed in the following section. Four of the species within the Wild Dozen have not yet had their global threat status assessed (e.g., based on the IUCN Red List threat categories and criteria), and a further four had their last assessment in 1998. Some, such as liquorice and goldenseal, are lacking social data on harvesters. All wild-harvested ingredients, within the Wild Dozen and beyond, deserve greater attention from industry, consumers, and decision makers, towards responsible sourcing and supportive policies and interventions where appropriate.

INDUSTRY

- **Determine which wild-harvested ingredients you are using** in your products. The Wild Dozen are a good place to start – do any of your products contain these flagship wild ingredients? Access the WildCheck platform as a starting point.
- **Investigate and invest in traceability** of your wild-harvested ingredients.
    - Can you track them each step along the value chain, from harvesting to manufactured product?
    - Can you determine what country they come from, which regions and communities within that country, and what species they derive from?
    - What information is missing?
    - Ask your suppliers to provide this information, or begin constructive discussions around how you might work together to ensure supplies are sustainable and equitable, and are tracked along the value chain.
- **Prioritize long-term relationships** with suppliers, participating in frequent dialogue to determine the producer's production capacity, local living wages, equitable prices per kilo of material, access rights issues for harvesters, gender equality issues, benefit sharing within communities, representation, use of traditional knowledge, and so on. This will help your relationship become more equitable, sustainable, and trusting over time. It is important to ensure your demand for raw material will not put undue pressure on the species or encourage overharvesting, or unethically commercialize traditional knowledge without consent, agreements, and benefit sharing.
- **Investigate and understand traditional uses** of species and knowledge associated with processing, cultivation, harvesting, and other aspects of sourcing raw materials. Companies must engage with Indigenous Peoples and local communities (IPLCs) to negotiate fair and equitable agreements for the use of traditional knowledge.
    - In most countries of the world, under ABS measures put in place following the 1992 Convention on Biological Diversity and the 2010 Nagoya Protocol, companies bear a legal obligation to receive prior informed consent for the use of traditional knowledge and resources, must negotiate agreements with "mutually agreed terms", and must equitably share benefits (United Nations, 1992; Secretariat of the Convention on Biological Diversity, 2011).
    - There are a number of standards and guides that can be referred to for best practice in these aspects, such as FairWild, UEBT, International Society of Ethnobiology Code of Ethics, the FAO toolkit on Free, Prior and Informed Consent (FPIC) (2016), and the Convention on Biological Diversity's Access to Genetic Resources and Benefit-sharing online course (n.d.).
- Where possible, **visit suppliers** and/or speak with them directly to ensure that child labour and forced labour are not occurring.
    - Anti-Slavery International, the Centre for Child Rights and Business, and the Ethical Trading Initiative list resources on these challenging topics and provide a starting point.
    - If child labour is occurring (for example children assisting parents with the harvest), work with the supplier to bring it in line with the FairWild Standard's best practice safeguards, for example no more than two hours of work per day, no hazardous work, no children younger than 12 working.
- Ensure that prices paid for raw materials **benefit communities and producers**, and are fair and equitable.
    - The Global Living Wage Coalition provides a guide on living wages in various countries around the world, which can be a starting point to consider how the wild ingredients you purchase fit into harvesters' overall income-earning activities.

WILD PLANT INGREDIENTS URGENTLY REQUIRE MORE ATTENTION from businesses, consumers, policymakers, researchers and practitioners

- Agreements for supply of raw materials should be long term, and companies should support the capacity of local groups to engage in these and other commercial partnerships.

- **Engage** with local producer and community groups, alliances, civil society organizations, NGOs, government, researchers, and businesses operating in the industry or region as part of efforts to encourage sustainable harvesting techniques and support capacity-building on a broader, more impactful scale, and ensure you understand and respect local norms, processes, and practices.

- Certifications can be a supporting tool to **ensure responsible sourcing**. FairWild and UEBT assure both ecological and social responsibility for wild plants. Other standards exist, such as Fairtrade or FairForLife, which focus on social responsibility. Others that can be applied to wild-harvested ingredients include PEFC, FSC, Organic, Rainforest Alliance, and Certificate of Origin (for example DOP/PDO, PGI, TCG). Efforts are needed to ensure information on and access to these various schemes is facilitated by companies, particularly for partnerships with small harvester and producer groups.

- **Celebrate and promote the use of wild plant ingredients** in your products using **#WeUseWild.** This can be used to share responsible sourcing tips and experience. Challenge your peers and competitors to declare their use of wild ingredients by using the hashtag too, while increasing awareness about these critical, wonderful, yet often undervalued ingredients.

- Sign the #**WeUseWild Pledge** to publicly declare your use of wild plant ingredients and commit to improving the biological and social sustainability of the wild ingredients your organization uses.

- **Industry associations:**

  - Encourage your members to read and follow recommendations within this report.

  - Identify the wild plant ingredients that are most relevant to your members and share information on their risks and opportunities, using the Wild Dozen as a starting point.

  - Create collaborative forums where members can share responsible sourcing advice and experience.

- **Traders** (for example manufacturers, processors):

  - Identify the wild plant ingredients you trade if you are not already familiar with them. Use the Wild Dozen as a starting point: understand the types of ecological and social risks and opportunities particular to wild plant ingredients.

  - Engage with both suppliers and buyers to encourage sustainable and ethical practices throughout the supply chain, to support the long-term availability of these wild ingredients.

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BOX 6

A TOOLKIT FOR RESPONSIBLE HERB SOURCING

The **Sustainable Herbs Program's Sustainability and Regenerative Practices Toolkit** is a collection of resources and best practices specific to the herb and botanical business sectors, that businesses of any size can use to become more socially and environmentally responsible. It is based in an ethos of caring for the people and planet from where herbs originate.

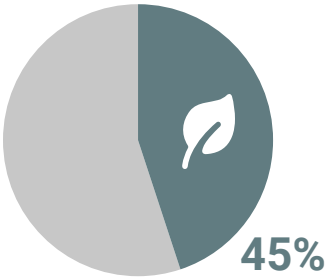
The toolkit provides resources and inspiring ideas to deepen existing efforts to solve issues of sustainable stewardship and regenerative collaboration with plants, planet, and people. It also aims to awaken conversations within and among companies on how to collaborate to address pressing challenges including rural-urban migration of harvesters, over-harvesting, soil depletion, climate impacts, and non-point contamination, among others.

CONSUMERS

- **Make informed decisions**, keep up-to-date on trends in wild plant use, and transform your environmentally- and socially-conscious values into action.
- **Notice** when you are about to buy or use a product containing a wild plant ingredient! Share a photo on social media using **#IFoundWild**. Tag your family and friends and encourage them to find the wild ingredients they use too.
- **Consider buying certified**, such as organic, PEFC, FSC, Geographical Indication, FairWild, UEBT, FairTrade, Fair for Life and Rainforest Alliance among others, wherever possible.
- If a certified ingredient/product is not available, **ask your favourite brands** via their social media or Contact Us page:
  - Do they know what wild-harvested plant ingredients are in their products, where they come from, and how they are sourced?
  - Without certification, how does a company ensure products are harvested sustainably and that producers and harvesters are fairly paid?
  - What do they do to support harvesting communities and wider biodiversity in the harvesting regions?
  - How do traditional knowledge holders benefit from the use of their knowledge?
- **Participate in FairWild Week** in June, or other specialized events, to raise awareness of the wild plant ingredients in our everyday products.

Consumers are ready for, and actively seeking to purchase from, companies taking a proactive approach to responsible sourcing.

In 2019, **two-thirds** of consumers said their **brand loyalty was motivated by a desire to make a positive impact in the world** (GlobeScan, 2019).



In 2020, **45 percent** of consumers said they are **making more sustainable choices when shopping** since COVID-19 and will likely continue to do so (Accenture, 2020).

In a 2021 survey, more than **one-third** of consumers said that **food and beverage companies are best placed to achieve positive change towards sustainable food systems**, ranking them higher than other stakeholders such as NGOs, the United Nations, agricultural companies, and individuals (GlobeScan, 2021).

Although this provides a clear opportunity for companies, it is important that any claims made are backed by evidence, action, and transparency to avoid greenwashing[7] and loss of customer trust.

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[7]The Merriam-Webster Dictionary (https://www.merriam-webster.com/dictionary/greenwashing) defines 'greenwashing' as: "expressions of environmentalist concerns especially as a cover for products, policies, or activities"

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DECISION-MAKERS

Decision-makers can include legislators, regulators, policy-makers, and resource managers.

Make conscious efforts to counter "plant blindness" (see Box 3) where it exists and incentivize sustainable use by taking actions such as:

- **Support, facilitate, and encourage data collection, monitoring, and reporting**. Spearhead more comprehensive data collection on wild plants – from resource assessments to trade and consumption data. Start with the Wild Dozen.
- **Set specific targets and indicators** on wild plants in biodiversity planning. Set specific actions, outputs, and indicators on commercially used wild plants and their sustainable use, based on best practices and standards, some of which are highlighted throughout this report.
- **Contribute to raising awareness** on the value of wild plants, and options for sustainable use such as certification, adherence to standards and legislation, and best practices.

The Biodiversity for Food and Nutrition's Mainstreaming Biodiversity Toolkit (2019) may help with implementing these points.

INVESTORS

Investors may be seeking to assess the opportunities surrounding the commercial value of wild plants and associated risks:

- **Use this report to better understand your wild product** of interest and its ecological, social and economic value. Don't forget to look at "associated species" if your product or species of interest is not a part of the Wild Dozen.
- The report illustrates the steps you can take to ensure viability of investing in different wild product value chains and identify stakeholders to engage with, as demand for health and well-being products in particular are on the rise.

PRACTITIONERS

Practitioners include agriculture, forestry, and development professionals **in local, national or international organizations or entities** seeking to develop projects and programmes on wild plants, or to influence policies.

As the evidence base on the value of NWFPs to societies and economies grows, an increasing number of development projects are including wild products in restoration, forestry, and food and nutrition initiatives.

- **Use this report as a starting point to identify the risks and opportunities** related to different wild-harvested ingredient value chains.
- **Make monitoring and evaluation a core part** of your efforts in the field – and make your data open access to contribute to improving data and, in turn, impact In Europe, data and information can be contributed to the INCREDIBLE knowledge repository for NWFPs (n.d.).
- **Support seeking Free, Prior and Informed Consent (FPIC) from traditional knowledge holders,** and adhere to national access and benefit sharing, indigenous knowledge, and intellectual property laws before engaging in or supporting wild product development initiatives that rely on traditional knowledge or indigenous resources.

The Biodiversity for Food and Nutrition's Mainstreaming Biodiversity Toolkit (2019) can be a supporting resource for practitioners.

PRODUCERS

Speak with your buyers about the wild ingredients you sell. Explain their seasonality, how they're harvested, and how this can affect capacity, cost, and availability throughout the year. Foster an understanding and respect for these ingredients, while sharing the incredible stories of these plants, their ecosystems, and the people who harvest them.

APPENDIX A. SUPPLEMENTARY METHODS

WILDCHECK PROFILE TEMPLATE

This template was used to assemble the Wild Dozen plant profiles. It may also be used to assist stakeholders using or making important decisions about wild plant ingredients. Key resources common to all wild plant species are listed below, while a complete list of resources is available in the References section.
These resources are non-exhaustive and should not be seen as a replacement for literature review, practice, ground-truthing, and consultation with wild plants specialists. The template, along with this report, is intended to be a starting point for stakeholders involved with and interested in wild plants

Key Information	Resources
Botanic identity and associated ecological information (common name, scientific name, how it is listed in ingredients)	RBG Kew's Plants of the World Online database http://www.worldfloraonline.org/ Kew's Medicinal Plant Name Service– synonyms https://mpns.science.kew.org/mpns-portal/
Wild-harvested or cultivated?	
Distribution	Global Biodiversity Information Facility https://www.gbif.org/ Useful tree species for Africa Agroforestry switchboard
Global conservation status	https://tools.bgci.org/threat_search.php https://www.iucnredlist.org/ https://cites.org/eng/app/appendices.php
Products/ingredients it is found in	http://www.whygowild.com/en/wild-plants-database https://www.herbalgram.org/resources/healthy-ingredients/ Literature
Other relevant species	Literature
Production • Areas of production • Who harvests/produces the ingredient • How the ingredient is extracted • What processing occurs (if any) • Access, social, worker, and equity rights issues	CITES Database FAO STAT Literature
Trade • Supply chain structure • Harvest and trade volumes (if available) • Prices trends (if available) • Health and nutrition information (if relevant)	FAO STAT UN COMTRADE Harmonized System (HS) Code data FAO INFOODS Food tree and crop composition database Literature
Risks (biological and social)	Refer to Methods section
Opportunities	Refer to literature, Methods section, and Conclusion section

INFLATION ADJUSTMENTS

Price data cited throughout the Wild Dozen profiles are as written by the original author, unless it is otherwise noted, for example 'USD XX, converted at 20XX rates' or 'adjusted for inflation/inflation-adjusted USD.'

Where prices were originally given in non-USD currencies, these were first converted to USD using the average exchange rate of the given year from https://www.oanda.com/fx-for-business/historical-rates, and then adjusted for inflation.

Where adjustments for inflation took place, the Consumer Price Index (CPI) was obtained from https://www.usinflationcalculator.com/inflation/consumer-price-index-and-annual-percent-changes-from-1913-to-2008/, using US Department of Labor Bureau of Labor Statistics figures. The CPI was then adjusted in all cases so that 2020 was the base year, or year 0. This was done in accordance with the methods elaborated here: https://people.duke.edu/~rnau/411infla.htm.

In cases where a period of time is described, inflation rates were calculated using the average CPI in that period. For example: From 1996 – 2005, the price per kilo of goldenseal root paid to the harvester was reported to vary between USD 44-77/kg (adjusted for inflation, calculated using average CPI 1996-2005: USD 65-114/kg).

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